THE

NATURAL HISTORY

OF

BEES.

CONTAINING

An Account of their Production, their Oeconomy, the manner of their making WAX and HONEY, and the beſt Methods for the Improvement and Preſervation of them.

ILLUSTRATED

With Twelve COPPER PLATES.

Tranſlated from the FRENCH.

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ADVERTISEMENT.

THE care and culture of Bees have always been one of the moſt agreeable and uſeful employments of a country life. The antients cultivated theſe animals with care, from a proſpect of honey, which was among them as much in uſe as ſugar among us. But ſince it has been thought proper to ſubſtitute ſugar in the room of honey, the latter has fallen into conſiderable diſcredit: but then, in return, wax has become the ſubject of a very conſiderable commerce. By this means Bees have always claim'd our care and regard, and the publick utility demands it.

'Tis not in towns we train up Bees; 'tis only in the country. Two ſorts of people employ themſelves in the culture of theſe laborious animals: the country people in

hopes of profit from them; and perſons of eaſy circumſtances add to this view that of an agreeable amuſement.

The firſt of theſe, too much taken up in laborious and continual employments, wherewith to gain their daily ſubſiſtance, can beſtow on their hives but few, and thoſe ſtolen moments, and a too negligent concern for ſuch an increaſe of Bees, as the good of commerce requires.

The other ſort, whom an eaſier fortune and a more improved genius would render capable greatly to advance an art, which at this time makes a conſiderable branch of the commerce of the kingdom, are diſcouraged by the difficulties of approaching theſe animals, always to be dreaded, and which one cannot manage eaſily; which makes them neglect thoſe experiments, that would enable them to make greater improvements than have hitherto been made.

If one has a clearer intelligence of theſe matters than others; if a man has rules to lay

lay down on the beſt conduct of Bees, 'tis to ſuch an one that we ought to refer them. Their ſkill, their knowledge, their time, which is more in their own power, makes it eaſy for them to try, and even to execute the moſt favourable methods for the multiplication and preſervation of Bee-hives. If they ſucceed, others will ſoon know how to imitate them.

'Tis not enough to inform perſons of underſtanding of the beſt methods we know, but we ought to make them ſenſible of the reaſons. By this means people born with a certain ſagacity execute with greater pleaſure, and more eaſily bring to perfection the new diſcoveries of others.

The practical reaſons for the ſucceſs of Bees are nothing more than the knowledge of their wants; and theſe wants can't be known, if one is not acquainted, with the utmoſt exactneſs, of their method of living, their temperature, their nouriſhment, the dangers to which they are expoſed, the moſt favourable ſituation they can be placed in;

if one knows not how to make them change their habitation, &c.

The antients have loaded their history of Bees with so many fables and absurdities, that it is not at all strange, if the prejudices, which arise from these false representations, have retarded the progress, which might otherwise have been made, in the training up of Bees.

To reinforce this profitable art, and to render it capable of the highest perfection; it was necessary, that somebody should give himself the trouble to make Bees his study more than the antients have done. This has been effected in our time; and we are indebted to three celebrated authors. Swammerdam is the first, who applied himself, with all that knowledge, of which so great an anatomist was capable: but his studies and discoveries go not beyond the interior and exterior parts of these animals; their generation, and their food: his design not extend-

ing to what might be useful either to preserve or multiply them. In short, his work, wrote in Latin and Dutch, is of no service to the persons we have in view. The late M. Maraldy, like the gods of the poets, who sometimes quit heaven to amuse themselves with terrestrial creatures; M. Maraldy I say, diverted himself, amidst his astronomical observations, with the study of Bees. This author has left us a very minute history of Bees, accompanied with many observations and discoveries. It is to be found in the Memoirs of the Academy, and consequently beyond the capacity of those persons, who have the most need of it. Besides, this author, as well as Swammerdam, gives no rules for the training up of Bees. They are both satisfied to examine them as naturalists. At length M. de Réaumur uniting the discoveries of all his predecessors to his own, has lately oblig'd us with a new history of these animals; which one may consider as the most compleat and perfect work, in all respects, that can be hop'd for in this kind; as well with regard to the natural history of Bees, as to the new

and eaſy methods, there propoſed, for their increaſe and improvement. This tract is found in the 5th volume of his *Memoirs intended for a Hiſtory of Inſects*; a work, which for the price, bulk, and extenſive learning, ſeems only fitted to the capacities of the learned and the curious.

Thus the deſtiny of Bees has this in particular, that all thoſe, who have moſt ſucceſsfully intereſted themſelves for them, who have beſt known them, and who have treated of them moſt learnedly, and with the greateſt exactneſs, have not writ but for ſuch, who have it not in their power to profit by their diſcoveries, and lectures, and have no real relation to Bees: whilſt thoſe, who breed them, and who might make their advantage of them by enlarging commerce, have ſcarce any knowledge of them.

This reflection has given me the notion of making thoſe diſcoveries and improvements more general, which ſeem lock'd up in the cabinets of the learned; to place before the

eyes of all thoſe, who have any deſire or any intereſt to be acquainted with them, the moſt proper means to bring up theſe animals, and ſo enlarge the commerce of wax.

'Tis with this view, and for theſe perſons only, that I have attempted this *Hiſtory of Bees*. I have taken all the materials from the memoirs of M. de Réaumur. One will be eaſily perſuaded, that I could not draw from a purer nor a more copious ſource. The form of dialogue, which I have pitch'd upon, appeared to me the moſt proper for inſtruction, without having that dogmatiſing air ſo diſcouraging to readers; who, through want of practice, find themſelves not fitted to attend to a continued and connected diſcourſe.

As my only aim was to make myſelf uſeful, I have made no ſcruple to make uſe of the obſervations, remarks, experiments and diſcoveries, which have already been made upon Bees by others; and have likewiſe employ'd their deſcriptions, ſuch as I found them, either intire or abridged, and ſometimes

times by inlarging them, when I was certain of not exceeding the bounds of truth. To what M. de Réaumur has ſaid, in his Memoir concerning Bees, I have added every thing which had relation to that ſubject, which is found in his other memoirs. I have preſerved, as far as poſſible, his terms and expreſſions, being perſuaded, that when things are well expreſs'd, an attempt to expreſs them otherwiſe is almoſt an inevitable riſque to expreſs them ill. If my conduct, in this particular, had need of an example to authoriſe it, I could cite that of M. Rollin in his antient Greek and Roman hiſtory.

As to the form of dialogue, which I have choſen, and the manner in which I have executed it, it belongs to the public to judge, whether I am in the right or no. I ſhall content myſelf with repreſenting Clariſſa as the miſtreſs of a family, reſiding in the country on her own eſtate, and whoſe underſtanding has no other improvement, but that which a good education, a knowledge of the world, and the reading of books, not abſolutely trifling, commonly give. Eugenio, the other perſon of the

the dialogues is the author; and though he borrows almoſt all his facts from M. de Réaumur, though he often copies his expreſſions, 'tis ſtill Eugenio, who is accountable for the uſe he makes of them. If he is deceived, his miſtakes are to be imputed to himſelf alone.

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Twelve COPPER PLATES to be placed at the End of the Book.

THE

THE NATURAL HISTORY OF BEES.

DIALOGUE.

EUGENIO and CLARISSA.

CLARISSA.

I WAS extremely disposed, Eugenio, to follow your advice, and to read the *History of Bees*, in the fifth volume of *Memoirs*, intended for an *History of Insects*, which you lent me. I was pretty certain of finding there all that you had promised me. But two Reflections made me change my design; the first is, that not having a head for abstract sciences, all that has the form and appearance of it terrifies me. You, however, represented this history, not only as very amusing, but as very learned. Perhaps you don't know, that if the amusing makes me advance ten steps forward, the learned, on

the contrary, ſets me as far back. The ſecond is, that it appears to me, that if I was deſirous, at this time of life, to employ myſelf in thoſe ſtudies, in which it is unuſual to inſtruct our ſex, and embelliſh my mind with them, ſuch a parade would but ill ſuit with my other indiſpenſible employments. What would the world ſay to ſee the miſtreſs of a family, at the head of a country farm, go alternately from the examination of a problem, to a review of her poultry, or from reckoning with her farmers, to a geometrical calculation? Methinks I ſhould have the awkward grace of thoſe country ladies, who having been at Paris, or Verſailles, mix the air of the court with their own country jargon. Let us each reſt in our own proper ſphere. Whether it be, that men have made theſe laws in conſequence of their own intereſt, as we are ſometimes apt to upbraid them; or whether it is the ſole effect of reaſon, ſtripp'd of all private views, which preſides over theſe cuſtoms: the laws are made; our birth ſubjects us to them, and we muſt obey. I am of the ſame ſentiment, with regard to cuſtoms; and conſequently with regard to that, which condemns us to an ignorance of the ſublime ſciences. So, ſee here's your book again: keep ſcience to yourſelves, and leave us to read only books of amuſement and diverſion; 'tis all that our ſex, at leaſt myſelf, muſt aim at.

EUGENIO. You do not uſe, Clariſſa, to take things with ſo much vivacity. Curious and probable diſquiſitions have always appear'd to me

to be in your taſte; and yet you cry out againſt them as much as if I had put into your hands Deſcartes, or Sir Iſaac Newton, to comment upon. Now our *Hiſtory of Bees* has nothing of reſemblance; it is the life of a people, induſtrious, laborious, and indefatigable; rigid obſervers of their own laws; full of foreſight and oeconomy; whoſe reigning paſſion is the good and proſperity of the Family; of a people, in a word, who ſeem to have taken their model from you. What can you find here ſo rigid and abſtracted?

CLAR. This is a moſt obliging Compliment: but what cauſes my apprehenſions, is to find the word problem at the opening of the book. We are there told, by way of applauſe, that one M. Kœning, the diſciple of Bernouilli and Wolfius, (ſtrange names for a woman!) had reſolv'd a problem, which the Bees put in practice every day. After this, we are preſented with a detail of the problem; which I moſt unfortunately light upon, and where I had like to have loſt myſelf. I am the Bees moſt humble ſervant; nor think I myſelf worthy to be acquainted with ſuch able Geometricians.

EUGEN. You reproach the author with the greateſt merit of his whole work. He ſhews us, that what man gains not but by a long train of deductions; that what Archimedes, Deſcartes, Paſchal, and ſo many others, who preceded the invention of ſublime geometry, were

not able to demonſtrate; he makes us ſee, I ſay, that the author of nature cauſes this to be executed before our eyes, by animals, to whom our pride denies underſtanding.

CLAR. I will confine myſelf to the moral, and will draw proper inſtructions from it; but I have no need, in order to admire the Creator's work, to loſe myſelf in demonſtrations, that paſs the bounds of my capacity. In a word, to abridge our diſpute, I conſent, that you, yourſelf, give me the *Hiſtory of the Bees*; nay, I beg of you ſo to do; but ſpare me their claſſes, genius, ſpecies, and all that learned detail. I only deſire to know the life, manners, inclinations, the imployments, labour, and induſtry of theſe little people. As when I read the *Hiſtory of China*, I have no need to have the Chineſe Kalender explain'd to me; but I ſhould like to be inform'd, how the ladies there, with a very pretty little foot, a ſmall noſe, little eyes, plump cheeks, a ſhape ſhort and fat, appear charming; that they there find a huſband, who, after ten years marriage, has not had a full ſight of his wife, tho' he has had ſeveral children by her. To conclude, I ask nothing of you but a romance, but the true romance of the *Hiſtory of Bees*.

EUGEN. I will endeavour to ſatisfy you: I will relate nothing but what has been carefully obſerv'd, and well atteſted: there will enter a good deal of the marvellous into my recital, but nothing of the falſe. I ſhall deſtroy the antient fables, with which, I doubt not, your infancy was

often amus'd. In return you ſhall have truths, that will not leſs ſurprize you, and will give you more ſatisfaction; but I ſhall have need of ſeveral audiences for this purpoſe.

CLAR. You ſhall have as many as you pleaſe. Every day, after dinner, we will retire into my walk of lime-trees; and there you ſhall tell me, at your leiſure, the wonders of that people; with whom, according to you, we have liv'd ſo long, and of whom we know ſo little. This place will be ſo much the more proper, as we ſhall have in view a dozen of hives; the advantage of which, hitherto, has been only known to my gardener.

CONVERSATION I.

Of the first objects, which a bee-hive presents.

EUGENIO.

METhinks I see, among your hives, one, that is a glass one.

CLARISSA. Yes, 'tis that, which I order'd to be made according to the plan, which you gave me. However, I own my cowardice; I never dare go near it, so great a fear I have of their stings.

EUGEN. Let us draw near to this glass-hive, and fear nothing. These are not men, but animals, instructed by nature, and faithful to their instructions; animals, that do not suffer themselves to be hurried away by the movements of an irregular passion. Do not attack or menace them, and they will not attack you. Glass hives are very commodious, to see, in gross, the work of the bees, their combs, and their different movements. This invention, tho' simple, is new: a hundred years ago it was unknown. The antients, who probably did not apply glass to so many purposes as we do, had some hives made, whose glazing was transparent horn: but these last ages have brought glass-making to great perfection. Before we take a view of the inside

inſide of a hive, let us begin by examining the outſide, which preſents itſelf firſt to view. A hive is a city well peopled, where we find commonly from ſixteen to eighteen thouſand inhabitants. This city is itſelf a monarchy, compos'd of a queen, grandees, ſoldiers, artizans, purveyors; of houſes, ſtreets, doors, magazines, and a polity. The queen, whom our fore-fathers (who did not make ſuch nice obſervations) call'd a king, inhabits a palace in the inſide of this city. I do not at all exaggerate, when I call it a palace; it is a dwelling vaſt and remarkable; of which I ſhall give you a clearer idea by and by. There the grandees have their hotels, and the populace their houſes. All theſe pieces, that you ſee pendant from the top of the hive, are call'd combs: they are all of pure wax; 'tis the ſame wax, which we make uſe of. Theſe holes of an hexagon figure, which you there ſee, are their houſes; of which ſome are more capacious than others. Here are the hotels, or apartments of thoſe, who, after the queen, hold the firſt rank in the republic, who are nearer to her perſon, and partake of her favours. The others are deſtin'd for the populace: they call them cells, or *alveoli*. All thoſe bees, which you there ſee in the air, either going, or returning from the fields, thoſe, which enter into the hives, or iſſue from thence with prodigious vivacity, compoſe that very populace, of which one part goes in queſt of forage, or returns from thence: ſome bring food into the houſes, where

it is distributed *gratis*; others return loaded with materials proper for building the public edifices. For the greater precaution, each Bee carries with him his lance; that is, that very sting, which to you appears so terrible. It would not be safe to plunder them upon the road; nor would an enemy find a kind reception, who should take it in his head to disturb their work, or insult their city. Every working Bee is not only an artisan; he is likewise a soldier, always arm'd for defence.

CLAR. That puts me in mind of those Jews, who repair'd the walls of Jerusalem; with the trowel in one hand, and the sword in the other. Ah! Eugenio: see, here's a Bee on my hand. See — he couches his lance.

EUGEN. Don't touch him, Clarissa; don't stir; permit him to retire, according to his own fancy.

CLAR. You are in the right; see, he is gone, without doing me any harm!

EUGEN. It will always be so. Permit them to walk upon your arms, your hands, your neck; and even on your cheeks: you will have nothing to fear, if you do not disturb them. Bees grow tame with men; their neighbourhood does not at all terrify them. Let us go nearer.

CLAR. Stay a moment. Tho' I have great confidence in you, I shall be glad, before I take one step farther, to clear up a certain suspicion: Have not I heard, that they can't suffer strong scents? I must inform you therefore, that I have

put

put into my hair ſome pomatum of jeſſamin. Will therefore this trifling delicacy bring upon me a ſtroke of their lance?

EUGEN. This averſion for ſcents is one of thoſe fables, with which it has pleas'd the antients to embelliſh the *Hiſtory of the Bees*. If we were to give credit to divers writers, we ought not to approach them, 'till we have ſtrictly examin'd our conſciences. They aſſure us, that they cannot ſuffer impure perſons, and eſpecially thoſe, who are guilty of adultery: that they give no quarter to robbers: that there are virtuous Bees, who love the virtuous, and know how to diſtinguiſh them. That fops, and curl'd and powder'd beaus, are their averſion. They tell us too, that there are certain times, when it would not be ſafe for the women to approach them. Ariſtotle goes farther: he pretends, that odors, whether good, or bad, determine them to attack the perſon, from whom they proceed. Believe nothing of all this: all thoſe averſions are pure fables. We ſee them continually lighting on the moſt odoriferous flowers; namely, on jonquils, tuberoſes, and lillies, which make your head ake; as well as upon the jeſſamin, your favourite; from whence they extract their honey, and collect their wax. One ſees them too ſettle and continue a long time on places moiſten'd with urine.

CLAR. I have nothing to ſay againſt their lillies and tuberoſes; but for thoſe places, ſo diſagreeably moiſten'd, I could not have ſuſpected them of ſo vitiated a taſte.

EUGEN.

EUGEN. We are all too hasty in our judgments. Pray what constitutes a good or bad taste; a good or bad scent? The senses, as well as the sentiments, don't fall in with the distinctions one may be apt to make: a whole nation of people differ, in this respect, from others; and, without going farther than ourselves, your smell is gratified with the scent of your sheepfolds, which offends mine; while that of woad, which you dislike, gives me pleasure.

CLAR. Methinks it would not be very difficult to determine certain smells to be really bad. In taking the plurality of voices, I fancy, one should find but few, who would speak in favour of those last mention'd places, which the Bees frequent.

EUGEN. Perhaps, more than you imagine. If the question was to collect the voices, in order to come at the proof, it is but justice to admit the beasts, since we are willing to judge of a sense common both to us and them; and which is nothing but a mechanical affection, where reason does not always preside. Now, in such an assembly, compos'd of men, beasts, birds, and insects, whose class is far superior to the others, taken collectively, I doubt whether I should not find the greatest number of votes. But, see, we are wander'd far from our subject: let us resume the thread of our history.

Plate I. Fig. 2.

CLAR. With all my heart; for, without reproach, you place yourself in pretty bad company. I should much rather be satisfy'd on the object

object I see before me. What are those lazy Bees about, who hang down in clusters from one of those combs?

EUGEN. Speak, if you please, with more respect, of a people, who go not to labour or repose, through laziness or caprice, as we do. They are Bees, which have deserv'd the repose they take; after which, they will return again to work, with greater ardour. If there is any thing particular in this their method of taking repose, 'tis not only in collecting themselves in a heap, as you see them there, but likewise hanging in to each other, by their feet, and being suspended in the form of a garland. This may be seen through that other glass square. Ibid. Fig 2.

CLAR. This is really a very pleasant fashion of taking a nap. I can't think, that the first, which support all the rest, are very much at their ease.

EUGEN. And I believe they are as commodious there, as they would be on your couch: animals know how to take their rest as well as men. We are not sufficiently acquainted with the mechanism of their springs, to judge of the attitudes, that best suit them. But we may safely refer ourselves, in this particular, to nature. We see, every day, something more surprizing in other animals. Do you call to mind that caterpillar, which I shew'd you one day on one of your apple-trees? Reflect, that I made you observe, when it had crept up one branch, and had fill'd itself there, its body was stretch'd out

to

to its utmoſt length, and tenaciouſly ſupporting itſelf with its two hind legs, form'd, with the branch, an angle of forty-five degrees; or, to ſpeak leſs learnedly, the animal appear'd ſtreight, like a ſtick erected on its end upon a plain, and in an oblique poſition; which our moſt expert vaulters can't perform for one moment, let them hook their feet with what force they pleaſe: and yet in this poſture it is, that the caterpillar takes its eaſe, and judges of us, perhaps, as we do of it. The repoſe of Bees therefore, having nothing more to furniſh us with, let us take our ſeat on this bench, over-againſt this other glaſs ſquare, where we ſhall better obſerve the inſide of the hive. See thoſe combs I ſpoke of, which depend from the top: there is a ſpace between them, big enough for two Bees to march a-breaſt, without embarraſſing each other; theſe are the ſtreets. There is a tract more ſpacious, of which there are ſeveral in a hive; theſe are the public places: theſe holes, or narrow paſſes, which croſs the combs on each ſide, are lanes or narrow ſtreets, wrought tranſverſly: theſe are made by the Bees to ſhorten the way, when they are diſpos'd to paſs from one comb to another. You are not, however, to ſuppoſe, that every hive, which we ſhall ſee, has exactly the ſame diſpoſition: they vary, as in our towns, according to the circumſtance of places.

Plate I. *Fig.* 6.

CLAR. I am now well acquainted with their ſtreets; let us enter into their houſes. Theſe, probably, are thoſe hollows of ſix ſides, which

are

are on the ſurface of the combs, and which you told me were nam'd *alveoli*. Each Bee has, without doubt, one peculiar to itſelf; where it performs family offices; and in the poſſeſſion of which, 'tis but juſt to maintain it.

EUGEN. Where there is no property, there can be no juſtice. Every thing is common among theſe people: there is no ſuch thing as mine and thine, and conſequently no plaintiffs or defendants. The *alveoli* are public edifices, which, like all the reſt, belong to the whole ſociety. Some are magazines, cloſed up, where they depoſite their honey againſt a time of ſcarcity: others are open magazines, for the daily food of thoſe Bees, which guard the houſe: in others theſe depoſite their unwrought wax, for thoſe who work, without ever ſtirring out: others (and theſe, without compariſon, the more numerous) are deſtin'd to receive the eggs; from whence new Bees are to take their riſe, and to nouriſh and bring up the little maggots, from whence they proceed.

CLAR. If it be ſo, tell me where the Bees paſs their nights: it is likely they lodge in the city. That gives me ſome diſquietude.

EUGEN. You have cauſe to intereſt yourſelf for them: they deſerve it; ſince they actually labour for you. But bid adieu to your fears: they paſs their night without changing their roof; either in cluſters, as we have juſt now ſeen them, or in the form of a garland, before their houſes.

CLAR.

CLAR. Before their houſes? That is to ſay, that they lye in the ſtreets. Farewel then the palace of the queen; farewel the hotels of the grandees, and houſes of the populace: ſee every thing converted, in a moment, into magazines, or the cradles of infants. I expected quite another thing from ſo politick a nation. The pleaſing deſcription you juſt now gave me, cauſes great regret in me to ſee it vaniſh ſo ſoon.

EUGEN. We do not always paſs a right judgment, when we refer every thing to ourſelves, and believe we are the common meaſure, by which every thing ought to be regulated: and that what does not reſemble us cannot be right. When the Creator had form'd this earth, he peopled it with animals, that is to ſay, with men and beaſts; and provided for the wants of both the one and the other. Our own wants are known to us; we know what to ſupply them with. Beaſts have the ſame knowledge. Why ſhould they be worſe uſed than we? They are, ſays Montagne, of the ſame family with us. But it was not neceſſary we ſhould be treated after the ſame manner; each is as they ought to be, and that well too, tho' in different manners. Omnipotence ſhines not leſs forth in the variety of created things, than in the creation. To ſleep before the door of its houſe, is as much the property of Bees, as for us to repoſe in our beds, or for a hare in the middle of a field. As to the queen's palace, and thoſe hotels you thought demoliſh'd, they ſubſiſt ſtill in their perfection.

perfection. It is true, when the Bees are arriv'd to a certain age, which, among us, we call maturity, they no longer make any particular uſe of them: they reſide in open air, and employ themſelves in their infancy. Let us now paſs to the different ſtates, which compoſe the nation of Bees. A hive commonly conſiſts of a queen, the only one of her ſex, of two, three, up to ſeven or eight hundred, and even a thouſand males, commonly called Drones; and of fifteen, up to ſixteen thouſand or more Bees, of no ſex, which I call the Workers; becauſe they are thoſe, to whom the whole management of the family is entruſted.

CLAR. One only female, a thouſand huſbands, fifteen or ſixteen thouſand domeſticks, who are neither male or female! You begin to tell me wonders betimes; will you abate nothing of all this as we proceed?

EUGEN. With regard to their number, I ſhall ſometimes have reaſon to retrench, ſometimes to augment; but never, with reſpect to the fact. You will ſometimes ſee two, three, or four Mother-bees; but, after winter is over, there is never more than one; and this one is ſo neceſſary, that a hive cannot ſubſiſt without her. The Queen, or Mother-bee, or Queen-mother, (for I ſhall indifferently give her one of theſe names) is the ſoul of the hive; 'tis ſhe, that puts every thing in action. In a hive, where there is no mother, all languiſhes, all labour ceaſes. Ariſtotle talk'd idly, when he told us, That

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when the Bees are depriv'd of her, they content themſelves to make wax combs, but lay in them no ſtore of honey: but he had only ſeen them ſuperficially. When they are deſtitute of a queen, they no longer amaſs either honey or wax; having no proſpect of proſperity, they embarraſs themſelves no more about futurity: they do not hoard, like our miſers, for the pleaſure of hoarding. When they perceive there is none to ſurvive them, they no longer diſquiet themſelves; they hive from day to day, and content themſelves to take their melancholy repaſts in the fields: but, preſently, the uneaſineſs to ſee themſelves the laſt of their race, makes them pine away, and they periſh in a little time. Give yourſelf the pleaſure to take the Mother-bee from the hive, and you will ſoon ſee it empty, either from mortality, or deſertion: I have had the experience of it.

CLAR. I ſhall never do ſo: diverſions of this nature are not for me. Methinks, you learned gentlemen, the deſire of knowledge makes your hearts terribly cruel: If beaſts are of the ſame family with us, you are but bad relations.

EUGEN. The orders you give your cook, in conſequence of which he diſpeoples your court-yard of its poultry, or your pidgeon-houſe; thoſe you give your huntſman, are they much more humane? Methinks your table is no commendation of that tenderneſs of heart, which animates you againſt the learned. Which has more

more right to be cruel, the desire of satisfying one's appetite, or that of instructing ourselves? own frankly, that we have nothing here to reproach ourselves with: So let us continue our subject. I shall have frequent occasions to mention the attachment, tenderness, respect, and duty, which the Bees pay to their queen: but, to give you, at present, a high idea of that admirable fidelity for their sovereign, which renders them so praise-worthy, I will only relate two very odd facts. Swammerdam, an author you are not well acquainted with, but whose testimony may easily be admitted, drew the Mother-bee of a swarm by one of her legs, with a small bit of thread fasten'd to a long pole. The whole swarm immediately assembled round the end of this pole, to cover the Mother-bee. This swarm was carry'd wherever the bearer pleas'd, in pursuit of the pole. The other fact is this. I remember to have seen you reading the *Travels of P. Labbat:* I make no doubt but you took for a pure romance that, with which that father inlivens his history, his relation of the Bee-man.

CLAR. Help me to recollect the fact.

EUGEN. These then are pretty nearly his words: "He receiv'd a visit from a man, who "call'd himself the master of the Bees: whe-"ther he was their master, or no, 'tis certain "they follow'd him as a flock of sheep does their "shepherd, and even closer too; for he was "entirely cover'd with them. His cap, par-"ticularly, was so covered, that it perfectly re-

" ſembled thoſe ſwarms, that endeavouring to " ſettle, fix on ſome branch of a tree. They " bid him take it off, and the Bees placed " themſelves on his ſhoulder, his head, and his " hands, without ſtinging him, nor even thoſe, " who were near him.---This man muſt needs have " rubb'd himſelf with the juice of certain herbs. " He was preſs'd to tell his ſecret, but they " could get nothing out of him, but that he " was the maſter of the Bees. They all follow'd " him, when he retir'd : for, beſides thoſe he " carried about with him, he had legions, which " attended him."

CLAR. This man had certainly Swammerdam's pole ; or, rather, he was him himſelf.

EUGEN. I make no doubt but this jugler had ſome Mother-bee fix'd to his ear, or ſome neighbouring place, ſince that was ſufficient to make a whole ſwarm follow him. You may judge of this by the natural attachment the Bees have for their queen.

CLAR. You continually encreaſe the deſire I have to be acquainted with a mother ſo belov'd.

EUGEN. 'Tis my deſign to make you acquainted with her. But I fancy we have talk'd enough about her for to-day ; and that it would be proper to renew the ſame converſation tomorrow ; when I will diſcourſe with you, not only of this mother and her people, but likewiſe of the different ſtates, which compoſe her numerous family.

CON-

CONVERSATION II.

Of the queen of the Bees, and of the males, or drones.

CLARISSA.

YOU remember, Eugenio, that you owe me the deſcription of a queen; of whom I have, before-hand, form'd a very high idea.

EUGEN. Let us ſee the idea you have form'd; we ſhall afterwards give ourſelves the pleaſure to compare it with the reality.

CLAR. In the idea of a reigning queen, which is likewiſe that of every other ſovereign, I figure to myſelf an aſſemblage of clemency and juſtice, of humanity and haughtineſs, of prudence and action, a grand and majeſtick air, of an acceſs eaſy, and full of goodneſs, of a continual attention to the proſperity of her people, and of an inflexible ſeverity with reſpect to diſcipline and the laws; and a great many other fine things, which are not actually preſent to my imagination, and which, I fancy, I ſhall find in your Queen-bee.

EUGEN. Sovereigns, according to the portrait you have begun, and which, if you had pleas'd, you could happily have finiſh'd, are neceſſary among men, on account of the depravity, with which our nature is infected. Thoſe

who govern, ought to be poſſeſs'd of moral virtues, that they may be oppos'd to the vices of them, who are governed: but, where moral evil is unknown, nothing but natural virtues are required. Therefore you make a wrong calculation of the virtue you judge neceſſary to a Queen-bee. Our fore-fathers, who made no ſcruple to ſupply by fables, drawn from their imagination, what they could not diſcover in their ſearch of natural things, have given to the Mother-bee all the knowledge, foreſight, wiſdom, in a word, all thoſe qualities, and all the virtues neceſſary to govern a numerous people; over whom they have likewiſe given her a deſpotick power. They imagin'd, that nothing was done in the hive, but by her orders They have likewiſe given her ſtrength and power to execute thoſe orders. Two authors, of great name and reputation, talk to us of the Mother-bee in terms, which ill ſuit with their reputation. The illuſtrious *Rollin, citing Xenophon, compares a wiſe woman to the Mother-bee, commonly call'd, the king of the Bees. He ſays, that ſhe alone governs the whole hive, of which ſhe has the ſuperintendance; that ſhe diſtributes employments, animates their labours, preſides over the conſtruction of their little cells; that ſhe watches over the ſubſiſtance and nouriſhment of her numerous family; that ſhe regulates the quantity of honey, deſtin'd for that uſe; and that, regularly, at certain fix'd times, ſhe ſends the new ſwarms from the hive, to form a colony. To conclude; all which they do, either

* Hiſt. Anc. p. 47.

either within, or without the hive, they make them perform in consequence of the queen's orders. The head of a Bee, sufficient for so many different views, would be a strong head indeed, and much to be valued: but that of the Mother-bee, is probably exempt from all those cares. If she reigns, 'tis over subjects, who every moment know, that the good of their society demands what they perform; and who therefore never fail to do it. They never have occasion to receive orders. In this state every one, whether monarch or subject, pursues their original design, from which they never vary.

CLAR. It is very easy to be a sovereign, at this rate. I could easily accommodate myself to a government, which would require no greater fatigue. Since all the world necessarily knows what ought to be done, it seems to me, that our queen has no other cares than those of making much of herself.

EUGEN. We shall presently see, whether you would change condition with her, and, upon the same terms, hold the reins of empire. The sole office of a queen, but an office, the importance of which is known to the other Bees, and which makes this mother so valuable, is to produce a numerous posterity: 'tis this, to which she seems entirely destin'd, and the only title, by which she lays claim to royalty.

CLAR. It is likewise the principal object, and what one expects from the queens of all people.

EUGEN. It is true. But the views and wiſhes of the people terminate in obtaining an heir for the empire: but, among the Bees, their demands are much higher. A queen, who would merit the love of her ſubjects, muſt produce between ten or twelve thouſand children in ſeven weeks, and, commonly, from thirty to forty thouſand in a year.

CLAR. Ho! ho! you are in the right to fancy the honour of a throne is a dear purchaſe in this country.

EUGEN. This prodigious fecundity is an article, which demands a whole converſation, with which I will entertain you another time: at preſent, I will ſatisfy myſelf with finiſhing the portrait of the Mother-bee, and the two other orders, which compoſe a hive. The queen is eaſily diſtinguiſh'd from the reſt, by the form of her body: ſhe is longer, and more ſlender than the males: her wings are very ſhort in proportion to her body; whereas the wings of common Bees, and thoſe of the males, cover their whole body: thoſe of the female hardly reach beyond the middle, and end about the third ring.

Plate I. Fig. 3.

Ib. Fig. 5. Ib. Fig 4.

CLAR. Would it not be better to give me a ſight of her, ſince we are over-againſt a hive?

EUGEN. Doubtleſs, if the thing was eaſy; but it ſcarcely ever happens, to have a ſight of the Mother-bee. Many of the country people, whoſe buſineſs it is to take the honey and wax, have never ſeen one; and die without the ſight.

I have

I have had, for many years, a glaſs hive, without having ever ſeen the Mother-bee: the fault, certainly, was not for want of carefully looking for her; and I ſhould, perhaps, not yet have known her, had I not had recourſe to ſome expedients; of which I ſhall give you an account ſome other time. In fine, the queen is bigger than the males; the males than the working Bees: thus the queen is the largeſt perſon of her whole realm: ſhe joins to this air of majeſty a grave and ſolemn gate, a good deal of ſweetneſs, and a prodigious fruitfulneſs. 'Tis to this, that all the great qualities you ſuppos'd to find in her, are reducible; excepting this, and ſome other ſlight differences, a detail of which would not be very agreeable to you, ſhe pretty much reſembles, with regard to her exterior form, the working Bees; and has, like them, a ſting.

CLAR. A ſting!

EUGEN. Yes, a ſting. This, likewiſe, is an ancient error, that the king or queen (for they were ſo ill inſtructed, that they could not agree about the ſex) was not provided with that offenſive weapon. The Mother-bee carries about her a ſting, which differs not from thoſe of other Bees, excepting that it is bigger, and a little curv'd. The ſheath, which furniſhes the venom, which this ſting introduces into the ſkin, is likewiſe found in her. I had the curioſity to put ſome of this venom upon my tongue, and can tell you, it is burning and cauſtick. We ought to do juſtice to Ariſtotle, and except him from the general number of the an-

cients, who have denied this Queen-bee a ſting: he was but half deceiv'd in this particular. He agrees, that the Mother-bee is provided of a ſting; but then he pretends, that ſhe is not arm'd with it, but for dignity; and that ſhe makes no uſe of it. It is true, ſhe is extreamly pacifick; and that one may handle her, and turn her, and even teaze her, for ſome time, before ſhe determines herſelf to vengeance; but, at laſt, ſhe determines, when it is abſolutely neceſſary. The fault was wholly my own, that I had not the honour of being ſtung by a queen: but I judg'd it proper to deprive myſelf of it, believing, that experience would teach me nothing more than I had ſeen.

CLAR. You are not, Eugenio, as yet, above half learned: having felt the venom, you ought likewiſe to feel the ſting. I have a right to refuſe my aſſent, 'till you have been well ſtung.

EUGEN. When the preſumption is ſtrong for the affirmative, the negative is not admitted, but after ſufficient proof, on the part of him, who denies. Therefore I would not adviſe you to wrangle; but firmly to believe, that when a Queen-bee has been at the trouble to ſting ſome inſolent, who has made himſelf too familiar with her, ſhe cauſes a wound larger and more painful than the other Bees, a wound proportion'd to the inſtrument, which makes it.

CLAR. 'Tis a truly royal character to be ſlow to puniſh; but to do it in ſuch a manner, that the example may be capable to deter others;

and

and that the remembrance of it may continue a long while.

EUGEN. Your reflection is juſt. But, beſides the moral ſenſe, which you rightly draw from it, there is likewiſe an eſſential phyſical reaſon, which requires it ſhould be ſo. It is this: The whole ſafety of the republick depends on the life of this queen; and, as it is of importance, that ſo valuable a life ſhould not be ſo often expos'd as that of ordinary Bees, nature has beſtow'd upon her a pacifick diſpoſition; which expoſes her leſs than others, to ſerve herſelf of that weapon; the effect of which is almoſt always fatal, both to the offender and revenger: as I ſhall explain to you ſome other time. Let us now paſs to the drones, or males; that is, to the thouſand huſbands of this ſingle queen. They call them the drones, to diſtinguiſh them from other large flies, more commonly known under the name of Drones. They are not ordinarily found in hives, except from the beginning or the middle of the month of May, till towards the end of July: their number is encreaſing every day, during this interval: and 'tis never greater, than when the queen is in a condition to multiply the ſpecies, and in thoſe, which immediately precede that, wherein they all diſpear, or the majority of them; and, in few more days, they too will finiſh their life by a violent death.

CLAR. How, by a violent death? You make me tremble! Would the Mother-bee be a perſon

perſon to renew the frightful nuptials of the daughters of Danaus ?

EUGEN. 'Tis one of thoſe true and ſingular facts, many of which you will ſee in the courſe of this hiſtory ; but it is not yet time to entertain you with them. The drones, of which I have already made mention, are ſmaller than the queen, and larger than the working bees. As we are yet in the ſeaſon proper to find them very eaſily, let us look through this glaſs, whether we cannot meet with ſome.

Plate I. Fig. 4.

CLAR. Is not this one of them, here ?

EUGEN. You are in the right ; ſee, here are many of them, which take their walks very negligently. The life of theſe is very different from that of the other Bees : it is conformable to the ſole employ, to which they are deſtin'd, to the honour of being huſbands to the queen, and fathers of a numerous poſterity : that certainly requires a diſtinction ; therefore they have a very great one. Except the moment, in which their ſervices may prove eſſential to the queen, they are exempt from all labour. To live, is the only thing they have to do. A life ſo ſoft and delicate could not be ſupported, but by very ſubſtantial food ; therefore they eat nothing but what is very choice, and of eaſy digeſtion. They live, in reality, on nothing but honey ; whereas the working Bees eat a good deal of coarſe wax. Theſe, being brought up more hardily, take their way to the fields, at the riſing of the ſun, and return not home without being charged with

honey and wax for the common good of the ſociety. The drones, on the contrary, go not out, till about eleven in the morning, to take an airing, and a ſlight repaſt, and return exactly before ſix in the evening; ſo much are they afraid of cold air and damps. To bear arms is not intended for the ſlothful and voluptuous: they would be of no ſervice, but to diſhonour them; therefore they have them not. They wear no ſting. Some body, but let not that ſome body be you, Clariſſa, might be tempted to envy the honour of theſe drones, and their ſoftneſs of life; but would ſoon find cauſe to repent. We ſhall ſee, in the ſequel, that the term of a life ſo delicious is very near its commencement; and that it always finiſhes by a tragical end.

CLAR. So much the better: it is an example I will never fail to repreſent to my children.

EUGEN. The beſt uſe one can make of human knowledge, is frequently to draw from thence inſtructions for ourſelves and others. The drones not being form'd for the gathering wax, or putting it to any uſe, nature, who makes nothing in vain, has not given to them as to the other Bees, pallets, which may ſerve them as ſo many baſkets to bring wax to their hive, nor teeth jutting out and proper to knead and faſhion it. The teeth of theſe drones are little, flat, and obſcure: their trunk likewiſe is more ſhort and thin. There is likewiſe ſome other dif-

differences in their exterior parts; but there is one, that can't be paſs'd over, without particularly attending to it; that is, their eyes. The eyes of the males cover the top of all the upper and under parts of their head, whilſt thoſe of common Bees only form a kind of oval cuſhion, or roll on either ſide. I ſee, very opportunely, at the bottom of the hive, ſeveral dead Bees, which will aſſiſt me to ſhew you that, which I could not ſo clearly deſcribe to you. Here is one. 'Tis a male, too. Don't you ſee theſe two large eyes.

Plate II. Fig. 1.

Ibid. Lett. A A.

CLAR. They are prodigious. It appears to me, as if the two together are much bigger than the reſt of the body.

EUGEN. That is true. This part, ſo eſſential to every animal, who has occaſion to tranſport itſelf from one place to another, has been, (luckily for us) examin'd very carefully, by able philoſophers, in our own times. Nay, it ſeems too, as if they had given the preference to the eyes of flies, on account of the particularities they have met with in them, and which are common to all, as well Bees, as other kind of flies. For this reaſon I ſhall enlarge a little on this article, and hope to find diſcoveries on this ſubject, which will, at leaſt, afford you as much pleaſure, as the pretty little feet of the Chineſe ladies.

CLAR. I underſtand your raillery, Eugenio: Let us ſee then the rarities you have to inform me of, with regard to the eyes of flies.

EUGEN.

EUGEN. Insects have not, perhaps, any other part more proper to shew us, with what prodigious magnificence nature has form'd them, and to shew us, in general, how many wonders she has wrought, which escape us. So those, who have employ'd most time in studying insects by a microscope, as Bonnani, Hooke, Lewenhoek, Puget, have not fail'd to take notice of these eyes. Those of flies, beetles, butterflies, and divers other insects, differ in nothing essential. All these eyes are, nearly, portions of a sphere: their exterior case may be consider'd as horney. They call the outward covering of every eye horny; as well our own, as those of other animals. That is it, which you may touch with your finger, if you are dispos'd; the lid remaining open. The eyes of those insects, which we treat of, have a kind of radience, which often present colours as much varied as those of the rainbow. It appears to the naked eye, unaided by a microscope, as smooth as glass. However, look at the eyes of this dead Bee through my magnifying glass, and tell me what you see.

CLAR. They appear, to me, cut facetwise, like a diamond. A work truly wonderful! What art! what regularity! What an hand that is, which is able to effect such things! The number of these facets is prodigious; is innumerable.

EUGEN. The number, however, has been counted. Lewenhoek has computed 3181, upon the horney part of a beetle's eye; and upon each of those of a fly. And M. Puget has calculated

17325 upon each of thoſe of a butterfly. And, not to make you wait any longer, that which is moſt ſurprizing is, that they pretend each of theſe facets to be ſo many eyes: ſo that, inſtead of two eyes, which ſome have ſcarcely granted to butterflies, we ought to aſcribe to them 34650; 16000 to flies, and other inſects more or leſs; but always in a very ſurprizing number. The diſcoveries made by theſe learned gentlemen inconteſtably prove, that every facet is a chryſtalline; and that every chryſtalline is attended with that, which forms a compleat eye. This is one of their experiments. They detach'd the horny ſubſtance from the eyes of ſeveral inſects: they took off all the matter, that adher'd to it; and, after having well cleans'd the inward ſurface, they put in its place the lens of a microſcope. This horny part, thus adjuſted, and levell'd againſt a ſoldier, made a whole army appear; againſt a flambeau, one of the richeſt illuminations, that could be ſeen. Lewenhoek has carried his diſſection ſo far, as to diſcover to us, that every chryſtalline has its optick nerve.

CLAR. I do not at all doubt of the ſagacity and exactneſs of your virtuoſi; and it is that, which cauſes my embarraſſment. When a Bee ſees a violet, an anemony, it really ſees more than thirty thouſand anemonies, or violets: how, then, can this fail of puzling it? How can it light, without heſitation, on the flower, which is real, ſince all the other are only illuſions of the ſight.

EUGEN.

EUGEN. You have two eyes; and yet, when you look at me, you don't see two Eugenio's.

CLAR. Philosophers save themselves by comparisons, when reasons fail them.

EUGEN. Reasonable philosophers have likewise another manner of saving themselves; which is often my own; and that is, to own my ignorance. We are not very well acquainted, how we see simple objects, altho' we see them with two eyes: but the fact is certain; nor do I believe that you will doubt of it. From thence it is easy to conceive, that insects, which may have a thousand eyes, may see objects single. But it cannot be that they can see them with all their eyes at once; the convex figure of the horny substance does not permit rays reflected by certain objects to fall on more than a small number of chrystallines, notwithstanding the thousand of eyes, which we consider as the organs of sight in animals, of which those two orbits are composed. The greatest part of flies have three others, placed in such a manner, as will appear to you very extraordinary. Those three eyes, which are as many chrystallines, but very smooth, and are not cut into facets, are much less than the two others. They have a triangular position on their head, between the skull and the neck. See them here on this Bee; where you may easily discover them with my glass.

CLAR. I see them. Their design seems to be to look towards heaven. Plate II. Fig. 12. Let. bbb.

EUGEN.

EUGEN. You may judge from this, that a fly, which walks on a plain, ought to ſee on ſeveral ſides at once. The difference of the eyes in the ſame inſect, the ſeveral places beſtow'd on the one and the other, give us room to ſuſpect, and with ſome probability, that nature has favour'd inſects with eyes, differently modified; with eyes proper to different purpoſes; that ſhe has beſtow'd upon them ſome to diſcover objects at a diſtance, and others to ſee them, when very near: that ſhe has provided them, as one may ſay, with microſcopes and teleſcopes. For example: A Bee, whoſe buſineſs it is to form an *alveolus*, and to work up its angles, accaccording to the moſt geometrical demenſions, ought to have its eyes very near the object. You would diſcover nothing, was you to look as near to the object as a Bee: its eyes then ought to have a conſtruction very different from our's, and fitted to ſee objects, not only very near, but likewiſe in the darkneſs of a hive. A Bee ought likewiſe to ſee afar off. For ſhe ſometimes wanders a whole league from her hive, and returns without any heſitation or fear of loſing herſelf. In fine, if we ſee on the ſame inſect, ſeveral globules of eyes, which differ conſiderably among themſelves, both as to bulk and figure, ought we not to conclude, that theſe globes contain eyes of very different offices: and wherein can the difference conſiſt, but in cauſing them to ſee ſome objects near, others at a greater diſtance, in repreſenting their bulk in the proportion it bears

bears with the body of the insect, either in shewing their bigness augmented or diminished. A singularity carefully to be remarked, and which is found on the greatest part of these eyes, form'd facet-wise, is, that they are cover'd with hair. When one views those of Bees with a very good glass, they are found to be cover'd with hair, which appear to us not very well placed. It is reasonable to suppose, that these hairs may hinder the rays of light from falling on these facets; but it must be observ'd, that they are upright, and not inclin'd, and that by this means, no rays, but in a certain direction, can fall upon them: besides, they are capable of detorting too great a quantity of useless rays, which would only embarrass the sight; and in this case would have the same use with our eye-lids.

CLAR. After so many subtle discoveries and enquiries, I should be scrupulous of proposing one of those objections, which I have heard are so confounding among philosophers, who love dispute.

EUGEN. Since truth is the aim, scruples and management are out of the question. Propose your difficulties, and confound me, if you can.

CLAR. Since you assume, Eugenio, this air of assurance, I absolutely deny the existence of eyes; and maintain, that you take for organs of sight, those, which are destin'd for other purposes; that, besides, their eyes are, for example, at the end of horns, as in snails.

EUGEN. Some philoſophers, and M. de la Hire, among others, have had the honour of being of your ſentiment. He would not own for eyes, thoſe globes cut facet-wiſe. But attend to experiments, which I believe will convince you, as he himſelf would have been convinc'd, had he known them. Mr. Hooke tells us in his Micography, that he had taken out the eyes of ſome flies, and that they wandred about as blind. Swammerdam had recourſe to a method more gentle and as certain; he put upon the eyes of certain flies, a covering of black ſteep'd in oil; he obſerved, that in this ſtate they flew at random, that they ſeemed to have no ſtrength, and that wherever they ſettled, they did not avoid the hand, which would take them. I my ſelf have made ſome experiments upon theſe eyes wrought in net-work or facet-wiſe, of certain Bees, all taken from the ſame Hive. I ſpread upon their eyes, a covering of dark colour'd varniſh: I ſhut them up, with ſome of their companions, which I had not touch'd, in a large powder-box. I was not above eight or ten ſteps from the hive, from whence I had taken them. When I had taken off the cover of the box, thoſe, which had their eyes clear, immediately took their flight, and went to their habitation: thoſe, whoſe eyes were varniſh'd, made no haſte to get out of the box, they had ſome difficulty to determine themſelves for flight; and the greateſt number directed it at random, and on different ſides, and went not far. To oblige ſome of them to fly farther, I

threw

threw them into the air; they raiſed themſelves vertically 'till I had loſt ſight of them, and knew not what was become of them. A pretty amuſing hunting of crows has been found out. Holes are made in the ground, in an open field. They place in theſe holes a coffin of paper glew'd on the inſide, and at the bottom of this coffin a bait. The crow, which touring in the air, perceives a bit of reddiſh fleſh, alluring to its taſte, falls upon it, and makes himſelf a ruff of this paper, thus ſmear'd with glue, and ſo much the more incommoding, as the ruff covers his eyes, and he knows not which way to get rid of it: thus muffled up, he raiſes himſelf in air, till you have loſt ſight of him; and they tell you, that he keeps flying ſo long, that he falls down, without any ſtrength, and almoſt dead. My Bees, whoſe eyes were thus varniſh'd, repreſented to me, in ſmall, an image of this hunting of crows. Not only thoſe, which I flung up in air, but all thoſe, which being more lively and more reſtleſs than the reſt, took a more elevated flight, fail'd not, in mounting higher and higher in the air, to diſappear from my eyes, and not one of them ſeemed to know the way to his hive. I was deſirous likewiſe of knowing what would happen, if I ſtopp'd the three eyes they have on their head. I put therefore varniſh upon them in the ſame manner as I had done to thoſe eyes formed in facets: I ſet them likewiſe at liberty, about three or four ſteps from the hive: not one ſeemed to know the way, or even to ſeek it. They flew

from all ſides upon the plants, but did not fly far. I never more ſet eyes on thoſe, which mounted in the air, as thoſe did, which had their large eyes varniſh'd over. It happens alſo ſometimes, that they make themſelves blind. I have often ſeen Bees, which flew, in whirling about near the ſurface of the ground; they did nothing but turn round, as if they had been mad. Without doubt theſe motions proceeded from the powder, put on the hair of thoſe eyes, made in net-work, for thoſe Bees appeared all powder'd. Judge you, Clariſſa, whether there would not be enough, from theſe experiments, to give a ſufficient anſwer to your formidable negative?

CLAR. Do you think, Eugenio, to pay your court to me, when you reduce me to a neceſſity of not being able to contradict you? I give you notice, that if you continue always to have your reaſons, you will puſh mine to the extremity.

EUGEN. You ſave yourſelf by pleaſantry, as I did, juſt now, by compariſons. I have deſcribed to you the Mother-bee, the males or drones: it remains, that I ſhould bring you acquainted with the Working-bees. We ſhall not find a whole converſation too much for this. It ſhall, if you pleaſe, be the ſubject of the firſt we have together.

CONVERSATION III.

Of the Working-Bees.

EUGENIO.

I AM, to day, Clariſſa, to entertain you with the Working-bees, thoſe very Bees, which have the care of the whole hive, which collect the honey and wax; which fabricate, faſhion and work up the wax; which build their *alveoli* with it; bring up the young; keep the hive clean; drive from thence the ſtrangers, and employ themſelves in all thoſe other concerns, of which we ſhall ſpeak, as occaſion offers. I ſhall not ſpeak, at preſent, but of their exterior parts; and that I may manage your delicacy, an enemy of long diſſertations, I ſhall only diſcourſe of thoſe parts, which have their offices well known, or have ſomething ſingular. Firſt of all, let us gather up this dead bee, and make uſe of my magnifying glaſs, to obſerve it. That, which is ſeen by our eyes, ſtrikes and effects us more than what we hear: firſt remark its head; it appears to you triangular: you are to know, that the point of this triangle is formed by the poſition of two long teeth, jutting out, and moveable. They are commonly found croſſed in dead Bees; but in this, they have not changed their ſituation. Their ſubſtance is ſhelly, and conſequently ſolid. When you hear talk of teeth, your idea of them is,

Plate II. Fig. 4. Plate II. Fig. 5. Lett. A A. Plate IV. Fig. 2. Lett. A A

that of inſtruments proper to break and divide the food. Among the Bees it is the leaſt noble of their employments: they are inſtruments, by means of which, they perform thoſe works moſt worthy of admiration. This is what I ſhall acquaint you with, when we come to the ſtructure of their *alveoli*. Theſe two teeth, which appear to you as flat plates, are nothing leſs than flat: ſeparate one from the other with the point of this pin, you will find they are a kind of ſpoons, whoſe hollow is on the inſide. The exterior circumference appears to you border'd with hair. I will tell you, in a moment, the uſe of theſe concave teeth.

Plate II. Fig. 5.

CLAR. I ſee perfectly all that you tell me. Theſe two teeth have the air of pincers, and cutting, ſuch as voracious inſects are poſſeſſed of.

EUGEN. Our Bees, however, are not carnivorous: there is ſomething more, which is, that theſe two teeth are not in the mouth, or, to ſpeak more juſtly, the mouth is placed elſewhere. I will give you ſight of it, in its turn: but muſt firſt ſhow you its lungs.

CLAR. You paſs, very quick, into the inſide of the animal. We ought, methinks, to have a good many of the exterior parts to examine firſt.

EUGEN. The lungs are exterior in all theſe inſects. The method of reſpiration, in theſe inſects, is ſo different from ours, that it deſerves we ſhould ſtop there a little. Raiſe up the two wings of the ſame ſide you hold it, you will find

find near the origin of the under wing towards the ſtomach, an opening reſembling a mouth. Plate III. Fig. 6. Lett. a.

CLAR. I ſee it.

EUGEN. That is the opening of one of the lungs. Let not this term impoſe upon you; there is nothing that bears leſs reſemblance to our lungs, in regard to their form, than thoſe of inſects: but the uſe of them being the ſame, with regard to reſpiration, and that being now our ſubject, I think it will be proper to make uſe of a well known and uſeful term. There is another of them more high, concealed by the firſt leg; and two more on the oppoſite ſide, which make the corcelet, (we call that *corcelet*, in inſects, which in other animals we name the breaſt) without counting twelve others, which are diſtributed on one ſide, and the other upon the ſix rings of the body. All theſe inſects in general, have like organs of reſpiration: the difference lies only in the number, and the places where they are fix'd. The ſilk-worm, and other inſects of the ſame ſpecies, have eighteen: the *Courtilliere* has twenty. *The Memoirs for a hiſtory of inſects* deſcribe many ſpecies of worms, which carry their lungs at the end of their horn.

CLAR. The lungs at the end of the horn? how odd it is! This reminds me of what you told me ſome few days ago, that an infant had been ſeen, who came into the world, with his heart out of his breaſt, hanging like a medal before it.

EUGEN. The natural order in this infant had been inverted; it was monſtrous, and the inſect, of which we ſpeak, would be equally a monſter, if it had its lungs in its breaſt. Nature knows how to fix every think in its right place. Theſe openings or lungs are named ſtigmata, and from them branch out, within the body, an infinity of ſmall canals, form'd of a ſmall whitiſh fibre, roll'd upon itſelf like the worm of a gun. Theſe canals ramify themſelves prodigiouſly, and convey air into all the parts of the animal's body. We emit air by the ſame canal, by which we reſpire: inſects, on the contrary, take in air by theſe ſtigmata, and return it by the pores of their body. Were one to ſtop theſe openings with oil, you deſtroy the animal, becauſe you deprive it of reſpiration. From hence it is ſaid, that oil is mortal to inſects. Let us paſs to other parts of them. Draw back a little the head of your Bee, you will ſee that it adjoins to the breaſt or corcelet, by a very ſhort neck, and this corcelet to the body by a very fine ligament. The body is cover'd over with ſix great pieces of ſcale, which ſlide one over the other, and form ſix rings which leave to the body all its ſuppleneſs, and defends it at the ſame time from fatal blows it might receive from without. To conclude, they are cloathed in armour, like our antient warriors, when they fought with bows and arrows.

Plate III. Fig. 3.

CLAR. However, I believe they have little to fear from ſuch like accidents.

EUGEN.

EUGEN. Don't poſſeſs yourſelf of too good an opinion of our Bees. They have doubtleſs ſurprizing qualities; but then they have others, which will appear to you ſo diſtant from what we call *reaſon*, and conformable to the abuſe we are accuſtom'd to make of it, that you will be often tempted to blame them. They have frequent quarrels among themſelves, and theſe quarrels often proceed to a fight with each other, or a combat of ſeveral againſt ſeveral. So it was neceſſary they ſhould be arm'd, as well for defenſive as offenſive war. You will ſee proofs of it in time. Let us now finiſh our deſcription. The *antennæ* are thoſe two kinds of moveable and articulated horns, at the end of which you would willingly place the eyes of the Bee. Almoſt all inſects have ſimilar horns, whoſe uſe is yet unknown. Plate II. Fig. 1, 2, and 3. Lett. D D.

CLAR. I muſt inform you then, for I am us'd ſometimes to obſerve and reaſon upon what I ſee; theſe horns are certainly the organs of touch or of taſte: chuſe.

EUGEN. I ſuppoſe they are neither one or the other?

CLAR. What are they then?

EUGEN. That is the very thing, that is unknown. It is perhaps the organ of a ſixth ſenſe, of which we have no idea. But let us paſs to things more eaſy to be known. The ſecond and third pair of a Bee's legs, have one part which we call the *bruſh*. This is it. This part is ſquare, its exterior ſurface is bare and ſmooth; its Plate II. Fig. 7, 8. Lett. A A.

its interior ſide is more charg'd with hair than our bruſhes; they are likewiſe placed in order. If one conſiders, with attention, a Bee upon a flower, the uſe it makes of theſe bruſhes is eaſily known, as the teeth and bruſhes are inſtruments given to the Bee, for the collection of that matter, of which wax is made: I will deſcribe, more at length, what this matter is, and the inſtruments, with which it is collected. I ſee yonder a faded lilly, which I will gather, to explain myſelf more eaſily. You ſee riſe from the middle of this lilly, ſprigs ſurmounted by a heavy part, which lie upon their upper extremity, and ſo croſs, as to give them the figure of a little hammer. Theſe ſprigs are called by the botaniſts, the *ſtamina* of the flower, and this little hammer the *ſummet*. It is not always of the ſame form you ſee it here. It is ſometimes only a capſula, which includes the powder, and at other times it bears its powder without; and this powder remains on the fingers of thoſe, who handle it, as in the lillies. There are true materials of wax; 'tis more, it is wax itſelf, but rough and unform'd. I ſhall make another digreſſion with regard to theſe ſtamina. I cannot let the occaſion ſlip, of informing you of one of nature's ſecrets, which the modern naturaliſts pretend to have ſtolen from her. You ſee, in the middle of theſe ſprigs, another part, which raiſes itſelf like them, and which terminates by a kind of button. It is called the *piſtile*. It is ſaid, that this piſtile is the female part, and the ſtamina the male: that

Plate III. Fig. 1. Lett. A A A.

Ibid. Lett. B

that the two ſexes are collected in the middle of the flower; that plants are hermaphrodites: that the dart of theſe ſtamina falling on the piſtile renders the ſeed fertile; and that every ſeed, not thus vivified by this duſt, remains barren. This ſyſtem of the generation of plants has been carried a great way: inanimate, as they appear to us, they have their amours, which have not eſcaped the ſagacity of our obſervators. This duſt then, which falls upon theſe ſtamina of flowers, is the ſole matter, of which wax is made, which I ſhall call rough wax. The ſeeds, which compoſe this duſt, have not figures form'd at random, like bodies bruiſed or ground ſmall. In every kind of flower, theſe ſeeds have a determinate figure: they are commonly of a round form, or rather oblong; they have likewiſe, ſometimes, very particular figures. The Bee, which would collect this duſt or rough wax, enters into the flower well blown, whoſe ſtamina are loaded with this powder, which adheres but very ſlightly. Then the briſling hairs rub againſt this powder, and charge themſelves with it: the Bee comes out all cover'd with powder, and of the ſame colour with it; which is ſometimes yellow, ſometimes red, and ſometimes of a yellowiſh white, according to the colour of the ſtamina: if theſe powders are ſhut up in the capſulæ, or boxes, as they are in many flowers; the Bee employs thoſe ſalient feet, which I ſhewed you, to open the capſula, and to get from thence that precious powder, with which all its hairs

are

are inſtantly covered: though there are ſeveral Bees, who, when they come to their hive, have their hairs full of this ſort of duſt, there are ſtill more, who before they think of returning, take care to clean and bruſh themſelves. I can't tell what determines them, to bruſh themſelves by the way, or to wait till they are returned to their hive in order to do it: but I can tell you, it is very curious to ſeé them. There is a certain time very proper for this; it is towards the latter end of winter, when they are weak and diſpirited; for when the warm weather has made them lively, you can no more follow the movement of their feet, than you can the fingers of an ablé muſician, who lightly runs over the violin or harpſicord. They have, as I have already ſhewn you, four bruſhes, upon their four hinder legs; but more particularly, two very large, upon their hindermoſt. It is eaſy to imagine how the Bees, by paſſing and repaſſing, its different bruſhes over the ſeveral parts of its body, can take off the powder, which ſticks to them. When I ſay take it off, it is not as we do our cloaths, in ſuffering them to fall: theſe materials are of a very great value to the Bee: ſhe collects them while ſhe is a bruſhing, and rolls them up in a little maſs. I have ſometimes had a very great pleaſure, to ſee their forelegs tranſport to thoſe of the middle theſe ſmall maſſes, and theſe again place and pile them up, on the triangular pallet of their extreameſt legs. This pallet, which I have already ſpoke of, in telling you, that the

Plate II. Fig. 7, 8. Lett. A A. Ib. Fig. 8. Lett. A.

Queen-bee and the males have it not, becauſe they are not deſtin'd to gather the wax, aſſuredly deſerves not to be forgot. The Bee has ſix legs, all of which are compoſed of five parts, articulated like our arms, which affords them a number of various movements. The firſt parts are very well furniſh'd with hairs, and theſe hairs are form'd like the leaves of trees, to be more fitted to collect the powder of flowers: but the third part, in each leg of the third pair, is what we call the *triangular pallet*. Theſe two words mark out their figure and their uſe. You may very diſtinctly ſee it with my glaſs. You will ſee likewiſe, that the ſame part, in the ſecond pair of legs, is ſhorter, ſtreighter, and leſs triangular, and that in the firſt pair it retains nothing of this form. The exterior ſide of this triangular pallet of the third pair of legs, is ſmooth and ſhining; the hairs erect themſelves above their edges: as they are ſtreight, ſtiff, cloſe ſet, and ſurround it, they form, with their ſurface, a kind of baſket. It is there, that the Bee collects thoſe little maſſes of wax, and in the form of a pin-cuſhion, which is ſometimes as big as a grain of muſtard. The two poſterior legs, are guarded, each, with a like cuſhion; the Bee returns home, charg'd with its plunder. In ſtooping a little, and looking at the door of the hive, we ſhall not fail to ſee ſome of them.

Plate II. Fig. 7.

Plate II. Fig. 7. Lett. B.

Plate III. Fig. 3. Lett. A A.

CLAR. I actually ſee many, who return thus charg'd; but they are not all equally ſo: probably

probably there are ſome of them better workmen than other.

EUGEN. That is true: but we muſt ſay, that fortune interferes ſometimes in their affairs: that ſome find plants better furniſhed with powder than others. When our free-booters ſet out for their courſe, they do not all return with equal plunder: the Bees, like ourſelves, are ſubject to the caprice of chance.

CLAR. What charms me, is the diligence, with which I obſerve thoſe ſmall animals return with their prey. Methinks I obſerve a greater joy in thoſe who are well loaded; workmen like theſe aſſuredly deſerve to live.

EUGEN. And ſo they do. The author of their being has provided for their neceſſities, in a very extraordinary manner. A compariſon will ſhew you all the advantage. If our reapers found, in the very field, where they reap'd, and at the foot of thoſe plants they cut, ſources of water, freſh, ſweet, and delicious, and proper to ſatisfy them as well as to quench their thirſt; their condition would not be ſo much to be pitied, as it ſometimes is. This is the caſe of our Bees: they find honey, at the foot of theſe ſprigs, loaded with duſt, which they collect. It is therefore from flowers, that the Bees extract their honey, as from thence they collect their wax. A modern author has obſerved, that flowers have a kind of bladders, or rather glands, which are ſo many reſervoirs of a honeyiſh liquor. Theſe

glands, in different flowers, are differently placed, but the Bees know where to find it.

CLAR. I will tell you where they are; for I remember, that chance, who often likewise interferes in my affairs, caused me to observe, one day, a Bee at work upon a flower: I saw it very distinctly plunge its trunk into the bottom of the cup, and hold it there a long while, in the lower extremity of one of those colour'd leaves, which compose the flower.

EUGEN. They call, in terms of botany, these leaves the *petals*.

CLAR. Petals be they then. It seem'd to me to pump it. But I don't now remember on what kind of plant it was.

EUGEN. Except pumping, for that they never do, the observation is good. Let us talk of the trunk or *proboscis*, since the discourse leads us to it. But first of all, I must guard you against the common prejudice, in informing you, that the trunk or mouth are two parts, very different, and separated the one from the other.

CLAR. It is then, as in an elephant.

EUGEN. Pretty nearly. The use of this trunk is not only to procure itself necessary subsistance, but it is besides employed by the Bees to collect that, which we appropriate to ourselves, as if it had been made for us.

CLAR. You doubtless, mean honey. I fancy we have as much right to this honey, as we have to the wax.

EUGEN.

EUGEN. As much as to the wool upon ſheep; 'tis a pure uſurpation on our part.

CLAR. Ho, for once, Eugenio, I catch you tripping. I ſhall be right, now, and you in the wrong. Anſwer me: Who manur'd this land? Who ſow'd theſe fields with corn, poppies, ſanfoin? was it the Bees? Who adorn'd my *parterre* with ſo many beautiful flowers? Who waters, forms, and works, during the extream heat of the day, this kitchen-garden, from which we have ſuch pleaſing hopes? The Bees think you? What, you will pretend, that they ought to come, with impunity, to take away the powder from the ſtamina of my flowers, without doing me the leaſt damage? And if this powder is ſo neceſſary, as you ſay, for the fecundation of the ſeeds, can you doubt, when they rob me of it, if they do me an injury? How many of my ſeeds have they made unfruitful, to make themſelves one pin-cuſhion of wax, as big as a grain of pepper? This little wax may perhaps have coſt me a buſhel of wheat, or a dozen of my faireſt peaches. It is but juſt, that they ſhould make me ſome amends for what I do for them, and for what I give them to live on. All that I can do, on your conſideration, and not to find them guilty of uſurpation, is to conſider them as farmers, with whom I have a contract for half their produce.

EUGEN. I did not expect, Clariſſa, this ſally. I am intereſted, as well as you, not to examine too nicely into this title of property. Therefore, not to have more debates on this head; let

let us resume our argument. I am now going to describe to you the trunk of your farmers; first, place one of their trunks before your eyes, and make use of my magnifying-glass. In holding the Bee in this position, you first of all discover one of these great eyes form'd facet-wise. Above are the two jutting teeth, and above them you see the trunk come down, applied to the hinder part of the head. It doubtless appears to you, as to me, a kind of plate pretty thick, very shining, and of a chesnut colour. I will immediately draw out the trunk with my little pincers, that you may see it at its whole length. You may now know, that there was but half the trunk to be seen, and that lay folded in two parts, of which one conceal'd the other. The concealed part begins at the place, which the point of my pin shews, and ends at the bottom of the head. This situation, where we have placed the trunk, facilitates the manner of letting you see the two essential parts, which were unknown before the author of *the Memoirs, to serve for an history of insects*. The first part is that opening, which you discover at the beginning of the trunk, which is the mouth. The second, which is higher, and which represents a nipple, is a tongue. Now for the trunk: when it appears in its place, and folded, as it is in the Bee, which makes no use of it, and such as at first you view'd it, that is not the trunk; 'tis only its case; the trunk is within it. It would therefore be proper to uncover it, and make you acquainted with

Plate III. Fig. 4. Lett. A.
Lett. B B.
Lett. C.
Plate IV. Fig. 2. Lett. B F.
Lett B.
Lett C.
Lett. D.
Lett. E.
Plate III. Fig. 4. Lett. C.

with its ſeveral parts: but you have ſo expreſsly forbidden me to enter into theſe learned minuteneſſes, that I have no other method but to perſwade you to read the book, of which I have given you an extract. If you are reſolved to take it on truſt, you can't refuſe your admiration and acknowledgment to him, who, with ſo profound a ſagacity, has diſcovered to us all the ſprings of ſo aſtoniſhing a machine. You will there ſee a deſcription of more than twenty parts, of which it is compos'd, and almoſt as compleat an anatomy of this wonderful organ. In fine, as you read it, you will fancy you ſee a workman, who takes to pieces a watch, which he himſelf has made, who lays before you the ſeveral pieces, makes you remark their fitneſs, their adjuſtment, their uſes, the play of their ſprings, the pivots, and the pillars; for all theſe are found in the trunk of a Bee. I have formerly ſeen a painting, which would ſuit as well or better our author, as him, whom it repreſented. There was Ariſtotle, with his pen in his hand before a table: over againſt him was Nature perſonized, ſpeaking to him, inſtructing him, lifting up her vail, to permit him to ſee her, and deſcribe her.

CLAR. If you meet again with that picture, I beſpeak one copy of it.

EUGEN. Though I ſhould cauſe an original to be made, you ſhall have it. I have but one word more about this trunk; which is, that it is not an hollowed tube from one end to the other,

other, as is commonly believed; nor is it a tube, which contains a pump, proper to ſuck and extract the honey: 'tis a kind of tongue, which moves like thoſe animals, which lapp: it plunges itſelf, and is buried in the honey-liquor, to make it paſs upon its exterior ſurface, together with the caſe of its trunk, from a canal, by which the honey is convey'd: but it is the trunk only, which being a muſcular body, cauſes by its different inflections and vermicular motions, the liquor to mount, and which puſhes it towards the throat. We may reckon the Bee's ſting among the exterior parts. Though it is conceal'd, when the animal would make no uſe of it, it appears but too often when vengeance and anger put it in action. Let us give ourſelves the pleaſure of ſeeing one with our eyes. I will ſeize a living Bee; here is one; take it by its corcelet.

CLAR. I am your humble ſervant: if it was dead, well and good; but as it is active, and I very unexpert, I will take care of myſelf: hold it yourſelf: put it into what diſpoſition you ſhall judge moſt proper: make it ſting you, ſtab you, if you pleaſe, I ſhall be a ſympathizing ſpectatreſs, but I pretend not to be expoſed to its ſtrokes.

EUGEN. The ladies well know, that a little cowardice don't miſbecome them: it is an advantage, which they do not neglect on occaſion.

CLAR. I have never heard, that the bravery of your Cæsars or Alexanders was the most shining qualification of a philosopher.

EUGEN. The repartee is lively; I may find some occasion to retort it as we go on: but I am of opinion to dispatch, first of all, what I have to say about the sting of a Bee. You see, Clarissa, that in holding it as I do, between my two fingers, I have nothing to apprehend from it: it has liberty to darts its sting; it spares not to do so, but it is to no purpose to torment itself, to twist its body on all sides, it can only pierce the air. See how it behaves with this glass.

CLAR. I see a lively image of choler and fury.

EUGEN. I must now let you see this sting in a state of rest. We need for that, only to force it to come out, and shew itself perfectly, by pressing the back of the Bee. Behold it attended with two white bodies, which together form a kind of box, in which the instrument is lodg'd, when it is in the body, that it may not hurt the inward parts of the animal. This small dart, which appears so fine and thin, is only a tunnel hollowed from one end to the other: I will presently convince you of it. Remark, that I press it towards its base, and you may see, that in pressing it, I make a small drop of liquor, extreamly transparent, ascend towards the top. I take off this; see another, which succeeds it. You have have cause to suspect, that this is that fatal liquor,

Plate IV. Fig. 1. Lett. A. Lett. B B.

liquor, which poiſons the wound made by the ſting. Fine as this inſtrument is, it is not ſo ſimple as one would ſuſpect. This point, upon which you have ſeen the little drop, is not ſo but with regard to our eyes: it is really blunt, and makes the extremity of a canal, which we have hitherto call'd the ſting: but it is time to be undeceiv'd. This canal is not the ſting, but its caſe: the real ſting is within it: from the extremity of this caſe it ſhews itſelf, and at the ſame time darts its poiſonous liquor. Let us proceed from wonder to wonder. This ſting, ſo very fine, is not ſimple but double. I intend to ſay, that there are two, attach'd together, which act at the ſame time, or ſeparately, according to the pleaſure of the Bee. Their ſubſtance is horny or ſhelly. To conclude, that I may thoroughly terrify you, their extremity is cut like a ſaw, whoſe teeth repreſent the barb of an arrow, which eaſily enters, but can't be got out without making terrible gaſhes. It has fifteen or ſixteen on each ſide. At the baſe of this ſting, but within the body, one finds the bladder, which holds the venom: the ſame ſtrings, which make the ſting play, at the ſame time preſs upon this bladder, to force from thence the deadly liquor, and dart it into the wound.

Plate IV. Fig. 3. Lett. B B.

Lett. C.

CLAR. This is like thoſe ſavages, who fight with poiſoned arrows. I am ſorry, that ſo barbarous a method of revenging themſelves obliges me to retract a good deal of that eſteem, which I had for theſe animals.

EUGEN. To make you amends, they will furniſh you with an example, which you will inculcate on your children, that vengeance almoſt always returns upon him, who takes a brutal revenge, in the heat of his paſſion. When an irritated Bee has fixed his ſting in our fleſh, or into ſome other body preſented to it, as a glove; if one hurries it to depart, as hardly ever happens otherwiſe, it leaves its ſting there, but not that only; the greateſt parts of its dependances remained attached to it, as the bladder of venom, and ſeveral of the muſcular parts. In flying from him, whom it has wounded, ſhe tears out her own entrails, which coſts it dear, more dear than a blow would coſt a man, who ſhould immediately loſe his arm by it. In fine, the wound, which it cauſes to itſelf, is terrible and mortal, and which it can't long ſurvive. The Bee ſoon feels the ſame pain it was deſirous to inflict on others.

CLAR. This is a fact, which I will this day regiſter in my collection, and will not fail to inform my children of it.

EUGEN. You are worthy, Clariſſa, to be a mother. I mean by this to ſay a great deal, for very few women merit that praiſe. It ſeems as if malice ſurviv'd the revengeful Bee. A proof preſents itſelf, which you will find pretty odd. After the Bee is gone, having left the fatal dart in the wound it has made, to die ſomewhere elſe, one would ſay it has committed to this dart, in parting, a proviſion of irritated and

choleric ſpirits, to finiſh its vengeance. Tho' the Bee may now be far off, the ſting continues to move in his fleſh, who has been wounded: do but ſee how it inclines alternately to contrary ſides: it plunges itſelf more and more, and ſtrives to make the wound it has given ſtill deeper.

CLAR. I dare not propoſe to contradict you, Eugenio: You are ſo well prepared to anſwer all the objections I can put to you, that I am reſolved only to aſk ſimple queſtions. I ſhall therefore firſt enquire of you, how you know, that this little drop, which appears with the ſting, is a venom, which enflames and poiſons the wound? Secondly, if this liquor is equally venomous at all times? Thirdly, if there are any preſent remedies againſt this ſting? Fourthly, with what deſign, nature has given to the Bee a weapon ſo cruel?

EUGEN. You will imagine, Clariſſa, that all theſe queſtions demand a long converſation. This ſhall be the ſubject of the next we have together. I tell you beforehand, that I ſhall begin with informing you how we know, ſo as not to doubt of it, that this limpid liquor, which flows from the ſting of the Bees, is a real venom, and that which makes the wound ſo painful. You will learn too by the manner, which we have taken, to come at the certainty of this, that philoſophers know when it is neceſſary, not only to deſpiſe, but even to encounter pain.

And I hope too to anſwer your pleaſantry, in forcing you to agree, that philoſophy has its Cæſars and Alexanders too, as well as war.

CLAR. I conſider it as a hardy attempt; I am apprehenſive too, it will be a raſh one. We ſhall ſee to morrow how you will extricate yourſelf from it.

CON-

CONVERSATION IV.

Of the venom of Bees: the wounds they make with their ſtings: their private and publick quarrels.

CLARISSA.

YOU are then going to prove to me, Eugenio, that philoſophy is capable of raiſing the courage, ſo as to deſpiſe the greateſt dangers, and to undertake the moſt arduous enterprizes: that is, in a word, philoſophers are ſo many Cæſars.

EUGEN. Can you think, Clariſſa, that I ſhould have much trouble to find, among philoſophers, heroes in courage equal to thoſe, whom the hiſtory of thoſe conquerors preſent us with? Every age, and almoſt every year, furniſhes us with examples. Would you have one of the moſt recent and moſt ſtriking? Compare the performances of the campaign of Charles XII. king of Sweden, during the ſevere froſt of 1709, to the battle of Pultowa excluſively, with thoſe of our Academicians, under the polar circle, to take the meaſure of the earth. You will find in both the ſame fatigues, the ſame courage to ſupport them, equal obſtacles, and equal intrepidity to ſurmount them; great and bold deſigns, and worthy of the moſt diſtinguiſhed valour: and in order to extricate them, men, whom neither hunger or thirſt, deſarts,

deſarts, or craggy rocks, the moſt ſevere colds, or cruel beaſts, could deter. To this I could add a million of other examples, which would not indeed be ſo diſtinguiſhed, but which would be more than ſufficient to prove, that philoſophy knows how to conſtitute a hero.

CLAR. I give up the fact, and will ſtick only to the number. You will own, that ſuch men, as you have juſt now mention'd, are ſoon counted over.

EUGEN. So are likewiſe the Cæſars and the Condes: but agree with me, that there are ſituations, which reflect an honour upon a brave man, though inferior to theſe great names. You will give me a place among them, when I ſhall have told you the voluntary pains, by which I arrived at the knowledge of the power and force of the Bees poiſon. I have already ſuppoſed it a very limpid liquor, which renders painful thoſe wounds, which, otherwiſe, would be but ſcarcely felt. This then I muſt demonſtrate by a very ſimple experiment. I made it, at firſt, upon myſelf: and ſome of our Academicians, and other lovers of natural knowledge, would have me try it upon them. With a very fine pin, I made a puncture on one of my fingers: before I did ſo, I took care to furniſh myſelf with a Bee upon a needle: after I had pricked myſelf with the pin, I ſqueezed the venom from the Bee; I forc'd the Bee to ſhew itſelf, and the venom to come out. I then took on the point of my pin a little drop of this liquor, collected at the

the extremity of its ſting; afterwards I cauſed the point thus dipped to enter into the wound, where I kept it but a moment: that was long enough to introduce the poiſon; which was no ſooner done, than I felt a pain equal to that, which is felt, when one is ſtung by a Bee. The ſmart of the wound cauſed by the envenom'd pin reſembles the ſtinging of Bees, more acute, or more moderate, according to the quantity of venemous liquor, infus'd into the wound; and, perhaps, according to the condition of the wound, that is, the largeneſs of the veſſels, that have been open'd, and according to the greater or leſs ſenſibility, of the nervous fibres, which have been wounded. I repeated this experiment, one day, on one of our Academicians, who doubted of its effect, or, at leaſt, of the degree of it. The better to convince him, I was not ſparing of the liquor; I cauſed a great drop to be applied to his wound, which I had taken from the ſting of an Humble-bee. The proof was ſtronger than he deſired: although very courageous, and one of our Cæſars, he could not feel the cutting pain of this little wound, without a good deal of ſtamping and ſwearing at the experiment. After this, which I have told you, I made another experiment upon myſelf, repeated ſeveral times, and on others likewiſe. Having drawn ſome of the poiſon from the bladder of a Bee, with the head of a pin, and put it on my tongue, I felt at firſt a kind of a ſweetiſh taſte, but which ſoon became ſharp and burning: I afterwards found ſuch a kind

kind of heat, as is cauſed by the milky juice of a thiſtle. That part of my tongue, on which the little drops had been applied, continued for ſome hours to feel, as if it had been ſlightly burned. Sometimes it was only a little over-heated. Swammerdam, who made this experiment before me, ſays, that this liquor had ſet his mouth all on fire; 'tis likely, that he had applied a ſtronger doſe. Are you now convinced, Clariſſa, that when the Bees ſting, 'tis this liquor, thus introduced, that enflames, burns, and renders the wounds painful?

CLAR. I believe you as much, as if I had felt it myſelf. We are perfectly well expoſed here to make the experiment without chuſing it. Should that happen, I fancy myſelf philoſopher enough to ſtamp to ſome tune.

EUGEN. Now to your ſecond queſtion, Whether their ſtings are at all times equally painful? I ſhall inform you, that all other things being equal, there are ſome times, when the wounds, occaſioned by Bees, are more ſenſible than others. Thoſe, which happen in winter, when they are benum'd with cold, are not near ſo painful, nor for ſo long a time, as thoſe, which are given in the ſummer; nor are they attended with ſo many accidents. It is likely, that the liquor is more exalted, more ſpirituous in ſummer than winter. Beſides, the Bee has not, perhaps, ſo great a quantity of it in winter, or, it may be, has not the force to make ſo much of it come out. Not only the different ſeaſons of the year diverſify the

different

different degrees of pain, but different perſons are not equally ſenſible of it. Some there are, which mind theſe wounds as nothing, in compariſon of what they cauſe in others. I have a ſervant, who ſcarce regards them at all. In whatever place he is ſtung, the place ſcarce ſwells at all: the parts round the puncture riſe not like what they do in other perſons. There is too a third cauſe, which renders theſe punctures leſs dolorous: it is when they are repeated by the ſame animal: the laſt are nothing in compariſon of the firſt. I happened one day to be ſtung by a waſp: I thought it worth the while to receive the wound with a good grace; I permitted him to ſting me at his own leiſure: in ſuch a caſe, the Bee, draws his ſting from the wound, ſafe and entire; and I had occaſion, that the waſp's ſting ſhould be ſo likewiſe; for having immediately ſeized it, and irritating of it, I placed it on a ſervant's hand, who had been accuſtom'd thereto. The wound, which it inflicted on him, was but little painful. I took the waſp again, and forced it to ſting me a ſecond time; I ſcarce felt the ſecond puncture. In fine, it was to no purpoſe; it would not be moved to ſting a fourth time. The venemous liquor was exhauſted in the three firſt eſſays.

CLAR. This proves very well, the great ſenſibility, cauſed by the puncture, proceeds from the venom introduc'd by the inſect. But if I ſhould tell you, that I know an animal, for whom this dagger and this venom are only ſport and paſs-time; that the bear voluntarily ſuffers him-

ſelf to be ſtung by the Bees, and that thoſe wounds are to him, but an agreeable tittilation.

EUGEN. Could I ſuſpect you of having read Pliny, I ſhould believe it is from him you have this little ſtory, which, however, he tells ſomewhat differently. He tells you, that the bear, when too fat, goes with a deſign to provoke the Bees, lodged in the trunk of a tree; and that he cauſes an infinity of punctures to be given him, eſpecially on his ſnout, which are very ſalutary to him. But honeſt Pliny has many of theſe ſtories, which would be better placed in the voyage to the Severambes. There is not, in all appearance, any animal, not excepting even the bear, to which ſuch venom would not give pain; the bear can only have more or leſs of it. It is certain, that this liquor is ſo briſk and penetrating, that one puncture of a Bee, if well ſeaſon'd, conveys it to the head, and the head grows ſtupified with it. Every country, and almoſt every county, tells you a ſtory of an horſe, who having rubbed himſelf againſt a hive, and thrown it down, was attacked by theſe angry animals, and died of it in leſs than a quarter, or half an hour at moſt. A ſimilar fact has been told by Ariſtotle, and confirmed in our time, (which was very lucky,) by witneſſes worthy of credit. There have been authors, who have determined the number of punctures, which would kill ſo large an animal: ſome have fixed them to twenty. I know not, if the doſe of venom, contained in that number of punctures,

may

may ſometimes be ſufficient for the death of the animal: but it is at leaſt certain, that there is a doſe, which diſtributed to the different parts of the body, would cauſe ſuch pains, inflammations and irritations, and, in fine, a ſort of fever, under which the moſt robuſt perſon muſt ſink.

CLAR. One can't refuſe you, Eugenio, the commendation of great courage. The voluntary trial you have made of a Bee's ſting, and its pernicious poiſon, with the only view of knowing its force, and to inform us of what we had reaſon to doubt of, merits certainly a place among the heroes of philoſophy. But I ſuppoſe you to be wiſe enough, to have taken a precaution, with which you have not yet obliged us. When you made theſe experiments, had you not ſome balm of Fierabraſs to apply to your wounds, to ſtop the pain, the moment you thought it proper, that you might not ſuffer more than was neceſſary?

EUGEN. You have reaſon to think, Clariſſa, I did not play the brave, beyond what I am: it is certain, had I known a remedy againſt this pain, I ſhould have uſed it. I will tell you too, that I did what I could to find one. A remedy againſt theſe punctures was one of thoſe queſtions you put to me yeſterday, and which I ought to inform you of. The late M. du Fay, of the Academy of Sciences, upon the foundation of ſome experiments, made in England, fancied, that the oil of olives was a ſpecifick againſt the ſtings of bees: he had ſo much the more confidence in it, becauſe in England they aſcribe to this remedy,

dy a virtue more powerful; ſince it is judged proper to cure the bites of vipers. In ſpite of all the credit one is inclined to give to the vertuoſi of that nation, M. du Fay was minded to make the experiment on himſelf. He made it. The opportunities of being ſtung by theſe animals are not difficult to be met with: he was ſtung on the noſe. When the oil was ſpread over the little wound, the pain was appeaſed; it returned no more, nor did any ſwelling appear. One day he told me the fact, knowing I had more occaſion than any body to try the experiment of this new remedy. In ſuch caſes I had often proved the effect of the oil of ſweet almonds; and the ſucceſs, which it had, could not diſpoſe me to think well of that of the oil of olives. However, I was tempted, at the end of a few days, to give it more credence.

CLAR. You was in the right; for why ſhould not you allow, that certain oils may have virtues, which other oils have not?

EUGEN. I do not at all doubt, that different oils may have different virtues; but one may lawfully doubt of facts, where eſſential circumſtances are wanting. When they have not been examined in every caſe, that may make them vary: you ſhall ſee a proof of it. One of my ſervants was likewiſe ſtung on the noſe: as I was preſent, I declined not to ſupple the part with oil of olives: he ſeemed to be well, and aſſured me, that he felt no more pain, nor had the leaſt ſwelling on his noſe. One would have thought, from

from theſe two experiments, join'd to thoſe made in England, the reputation of the oil inconteſtable. I ſhould have thought ſo as well as you, had I not known, how often certain experiments require to be repeated and varied. The next day I went upon an operation, that required I ſhould have ſeveral hands to aſſiſt me: it was one of thoſe, from which one ſeldom comes off, without being ſtung; it ſeemed to me to be very favourable to repeat the trials of the oil: the affair was to make Bees paſs from one hive to another. One of my aſſiſtants received a puncture upon his forehead, between his eyes, I took out the ſting, and rubb'd it with oil of olives: he thought himſelf eaſed, but his joy was of no long continuance; after a quarter of an hour, he could ſcarce open his eyes; the ſwelling, communicated to both eye-lids, kept them almoſt cloſed. I was myſelf ſtung five times, on the fingers and arms: you may reaſonably conclude, I did not fail to apply this ſpecifick; but as the old proverb ſays, I loſt both my oil and my time: my fingers, hand and arm remained ſwelled, and were painful. This remedy had no better effect upon many others, who had tried it.

CLAR. Why then did it ſucceed ſo well with M. du Fay, and your ſervant?

EUGEN. I met with a ſolution of this difficulty the ſame afternoon. The ſame ſervant, who found himſelf ſo well by the application of the oil, was ſtung by more than a dozen Bees, during our operations, on the fingers, hands and

arms, without complaining, or even without giving himſelf any concern about it, or any ſwelling attending the puncture, or having the leaſt recourſe to the oil. I have known people in the country, who would not ſo much as vouchſafe to put a glove on that hand, with which they cut the combs in the inſide of the hive, although they knew they ſhould be ſtung more than once. Theſe punctures, extreamly painful to other men, were minded ſo little by them, that they did not ſeem to think it worth while to confine their hand for them, and make it leſs at liberty, by wearing a glove. There are, perhaps, but too many remedies, which owe their reputation to ſome cauſe like the former, where we employed the oil; that is, becauſe they have been given in circumſtances, where they were of no ſervice to cure the hurt.

CLAR. Can the wounds, inflicted by Bees, be the only ill, againſt which medicine has no remedy, and apothecaries no plaiſter?

EUGEN. One finds ſome in choice books, as one does for the gout, the pain of the teeth, corns upon the toes, &c. whoſe greateſt virtue is, to keep thoſe, who vend them, from ſtarving. However, with regard to remedies, a man has no right to deny, what he has never tried. I have applied the juice of ſeveral plants, which have been told us, by divers authors, againſt this venom of Bees. I have tried urine, which is very much cried up, as likewiſe vinegar too. I have light upon nothing, which, though in ſome cir-

cumſtances ſucceſsful, has not proved uſeleſs in the end. What appears too much for a remedy one is minded to prefer, is, that there is not one of them, at the inſtant it is applied, which has not diminiſhed or appeaſed the pain. Water alone has produced this effect, but the pain always returns afterwards, attended with its conſequences. Shred parſley is the only thing I have tried, which has procured ſome eaſe, but with ſo little effect, that though I am one of thoſe, who feel theſe punctures very painful, I do not think it worth while to have recourſe to it. In a word, I know no remedy one can depend on. By the by, I will give you one advice, in the room of ſomething better, which will be uſeful to you in caſe of neceſſity; if not to cure you, at leaſt to hinder the troubleſome conſequences of theſe wounds: it is, never to fail to pull out the ſting from the wound, as ſoon as you feel yourſelf ſtung.

CLAR. Since you leave me without a remedy againſt the ſtings of Bees, and that I am abandoned by the phyſicians, tell me, however, for my comfort, what reaſons could nature have, to arm theſe terrible animals, to annoy us?

EUGEN. It is not certain, that we are the firſt objects of theſe animals vengeance. The Bees have ſeveral other important occaſions to ſerve themſelves with it, and have enemies of ſeveral kinds. The fruit of their labours, their wax and honey, excite the envy of many greedy and lazy inſects: they have alſo other enemies to

defend themſelves againſt, who are more fond of eating them than their honey. It ſometimes happens, that other inſects are fooliſh or raſh enough to enter brutally into their hives, where they would deſtroy and overturn every thing, if our Bees, like a ſquadron of Huſſars, did not fall upon them, and put either to death or flight thoſe raſh and inconſiderate creatures. I have already inform'd you of a time, in which the huſbands of our Queen-bee muſt be exterminated, and ſacrificed to the good of the ſociety. They are larger and ſtronger than the Working-bees: body to body, a Working-bee would have but bad ſport with a drone; but by means of its impoiſon'd ſting, it brings its deſigns about. There is ſtill another circumſtance, wherein this ſting may be of uſe to them. 'Tis in thoſe quarrels they have either among themſelves or foreigners, and which, ſome time or other, I ſhall entertain you with.

CLAR. Why do you put it off to another time, ſince a fit opportunity now preſents itſelf? I have an extreme impatience to know what the duels of Bees are, and to hear a recital of their general battles.

Plate VI. Fig. 1. EUGEN. It is eaſy to ſatisfy you. Don't you ſee at the foot of this hive thoſe two Bees, who ſtruggle and roll each other in the duſt?

CLAR. I have ſeen them a long while, but I thought they were at play together, and amuſing themſelves.

EUGEN.

EUGEN. This is not childrens play: thoſe are quarrels, that paſs the bounds of pleaſantry, and terminate moſt commonly in death: 'tis, in ſhort, a duel in all its forms. In fine and hot days, one may have often occaſion to obſerve theſe deadly combats among the Bees of the ſame hive. Sometimes the attacker and the attacked go out of the hive, taking faſt hold of each other. Sometimes it is without the hive, that one Bee will fall upon the other, which is flying: at other times it falls upon one, in a ſtate of repoſe, or which is gently walking on the outſide of the caſe of the hive. However the battle was begun, when they are once join'd, they preſently fall to the ground. They could not give each other ſure blows in air; and it would be difficult to ſupport themſelves there, while they endeavoured to give mortal wounds to each other. It is eaſy to obſerve, who will be thus engaged before a hive; you have actually a proof of it before you.

CLAR. Since this is a duel, let us ſtoop down, and obſerve it at leiſure.

EUGEN. Take notice, that theſe two combatants put in practice, what two wreſtlers would do, whoſe aim is to deprive their adverſary of life. See how both one and the other ſtrives to gain that poſition, which is the moſt advantageous. See them both lying on the ſame ſide, holding each other reciprocally in their claws, head againſt head, back againſt back, and twiſted in ſuch a faſhion, as to form a circle or an oval. It is owing to the motion of their wings, that

they whirl about from time to time as you ſee, and ſometimes put them a foot diſtance from each other, but always even with the ground. Take care. Here is one, which has got the aſcendant over his enemy, and mounts upon his body: all their movements, their flexions and different poſitions have no other tendency, but to find a ſoft place in their adverſaries body, where there ſting may eaſily enter. Admire the readineſs, with which their ſtings are darted. The moſt famous gladiators have not their wriſts more at command. I perceive this duel draws to an end. The death of a Bee will enſue. Obſerve how that of the two, which keeps the other proſtrate under her, applies its tail upon the neck of its enemy. There is an end. The one is dead, and the victorious Bee towrs in air, to enjoy its victory.

Plate VI. Fig. 1.

Ibid. Lett. A.

CLAR. I own, although I have not a cruel turn of mind, I have taken a ſingular pleaſure in ſeeing this duel.

EUGEN. Theſe combats would laſt but an inſtant, if the Bees were leſs advantageouſly armed; but in ſpite of their ſcales, with which their fleſh is covered, it is not however inacceſſible. If a Bee could paſs his ſting between the ſcale, and that vacancy or ring, which it ſome times covers, by joining itſelf to the under ſcale, it would ſoon plunge it into the fleſh. If the Bee, which defends itſelf, ſhould, ever ſo little, ſtretch out its neck, it becomes uncovered; if its enemy's ſting is then ready, it may wound it, as you have

have juſt now ſeen. I have taken notice, that they likewiſe mutually ſtrive to prick each other towards the baſe of their ſting, it may be in the anus.

CLAR. Don't they ſometimes attempt to croſs each others ſtings? for all animals, which are armed for the defenſive, ordinarily oppoſe arms to arms; oxen, horns againſt horns; dogs, teeth againſt teeth.

EUGEN. I would not deny, that this is their intention. As to the reſt, I happened one day to make an obſervation, which deciſively proves, that a Bee may plunge his ſting into the body of another. I ſaw two fighting as they came out of a hive. The combat paſſed upon the exterior part of the ſtand. It was not long: I immediately ſaw one of them vanquiſhed and expiring. I took it, examin'd it, and found, that the other Bee's ſting remained between the two rings of the belly of this. But, I ſuppoſe, this caſe is rare: for if it was common, every combat would coſt the two Bees their life. Theſe battles are ſometimes very long. I ſaw one, that required a whole hour, for one to kill the other. Sometimes both fatigued, and deſpairing of a compleat victory, retire, and each flies its own way. When they have both known how to avoid the ſtrokes of the ſting, the combat does not terminate in death.

CLAR. The folly of fighting is then in the head of theſe animals, as well as in that of men.

EUGEN. What is true and real folly in man may be only mechaniſm in beaſts: it may,

perhaps, only be an impulſive force, which would not proceed from their own choice, but from the inſtitution of nature, who has views of her own.

CLAR. I could be glad to know, what reaſons nature had to inſtruct one Bee to inſult another, in cold blood, and make it draw its ſword; or to fall, without the leaſt warning given, upon another Bee, who ſays nothing to it, and is going about its buſineſs, in order to kill it without other forms of proceſs.

EUGEN. Repuls'd as we are in penetrating into the views of nature, by the little ſucceſs, which we frequently meet with, one cannot help returning to it whenever occaſion offers itſelf. If we are allowed to gueſs at the policy of the Bees, or rather the intentions of nature, and to believe that their quarrels are not founded on ſuch frivolous motives, as ours too often are; one may think, that a reaſon ſimilar to that, which determines them to kill the males, determines them alſo to kill other Bees. The Bees, thus proſcribed, are, perhaps, lazy, gluttenous, who only add to their number, and conſume their food: perhaps they are idiots, who know not how to form an *alveolus*, according to the moſt exact rules of geometry: or they may be old, ſuch, whom age hath rendered incapable of performing their offices, and who only cauſe an embarraſſment, among an active and laborious people.

CLAR. I am of their opinion, in exterminating and driving from their civil ſociety the lazy, the gluttons, and the ignorant, who know

not

not how to do any thing: but with regard to the old ones, I am utterly againſt them; I make myſelf a party in a cauſe, in which I hope to be, one day, intereſted. Is it a reaſon to ceaſe to live, before the appointed time, becauſe but little of life remains? This polity appears to me abominable: how can you reconcile it with natural ſentiments, which are the only motives from whence brutes act? For ſimple nature, which is not yet perverted, directs us rather to reſpect old age than to deſtroy it. Apicide, as well as homicide, appears to me an act contrary to nature.

EUGEN. That is a queſtion, Clariſſa, that is not eaſy to anſwer, to determine what is, and what is not natural ſentiment: that is, what is moral good or evil. Happy for us, the Chriſtian religion has ſettled our doubts in all neceſſary caſes; but among thoſe people, who are not enlightened by our religion, the mind muſt be often embarraſſed to judge of what is good or otherwiſe: experience furniſhes us with many examples. 'Tis commonly agreed, that nature inſpires us with a particular reverence for the dead. To give them to be devoured by beaſts, appears to ſome an act againſt nature, to others not. We bury them, and believe we abandon them to worms. "The * Romans burnt them; the "Egyptians embalmed them; the Perſians wrapped them up in wax; the Magi interred them "not, till they had cauſed them to be torn by "beaſts; in Hircania, it was thought the moſt "honourable tomb a man could have to be eaten

* Cicero.

" by eaten by a dog; the rich maintained " ſome at their houſes, for this purpoſe, and " there were ſome, which were fed at the publick " charge." There are ſome people, who eat their dead fathers and mothers, from a principle of piety. If there be in the world a ſentiment, that may paſs for natural, 'tis certainly paternal love. Yet the people of Bengal throw their children into the river, when they have more born than they can maintain: others ſell them, and deliver them up to ſlavery. The Lacedæmonians would kill thoſe children, who they thought would be a charge to the publick. The Chineſe laws permit them to expoſe them in the ſtreets. Another ſentiment, which is equally one of thoſe, which nature dictates, is the reſpect of children towards their fathers and mothers. Yet one has ſeen people, who pretend to be civilized, amongſt whom it was a pious office, to kill their fathers and mothers, when come to a certain age: this cuſtom ſtill ſubſiſts among the Hottentots. Why ſhould we refuſe to Bees a charity equal to that of theſe people, who believe they treat their aged parents very favourably, in ſhortning the duration of their lives; thoſe days, which they would otherwiſe paſs in pain and miſery? At leaſt there is a probability, that it is for the good of their ſociety, which is the motive of their actions, that the Bees kill thoſe, whom they know to be no longer in a condition to contribute towards it.

CLAR.

CLAR. I am, it seems then, unacquainted with natural sentiments. I lose myself in this subject: all the answer I can make is, that I am perfectly convinced, that we must keep to those, which our religion, laws and customs have handed down to us: and that it is, to search too far, to endeavour to know the motives, which prevail on brutes, since we are often at a loss to give a reason for those, which influence ourselves. Therefore let us leave this argument, and return to our Bees. After having been so lucky as to find myself present at one of their duels, may I not flatter myself to see one of their general battles?

EUGEN. I cannot promise you that; they are not very frequent. It is possible to excite them to it, but there must be preparations for it. In the mean time, I am going to tell you what I know, and what I have seen. 'Tis scarcely ever but in swarming time, that one sees these publick rencounters. When a colony of Bees, abandoning their domestick lares, goes in search of a new habitation in some foreign country; if it should fall unluckily upon one already inhabited, that is, upon a hive, which other Bees are in the possession of, (it matters not whether it has been long since, or only some few hours) the new comers meet with their match. The proprietors being in their own quarters, are strong, and not much disposed to divide their habitations; they therefore defend their castle. 'Tis then that one of these general battles is fought.

CLAR.

CLAR. This pretty nearly reſembles the invaſion of the Huns and Vandals.

EUGEN. We often find in the actions of brutes compariſons between them and men, which do not turn out to our honour. I remember one day, that being reſolved to confine a certain number of Bees, with their queen, in a hive, which they found to be too little for them, after a good many trials on both ſides, of theirs to depart, of mine to make them enter, at laſt they eſcaped, and with their conductreſs went to mix themſelves among a ſwarm, which had lately ſettled itſelf in the neighbourhood, in hopes, it ſhould ſeem, to make but one people with thoſe, which were already there. Theſe laſt not finding themſelves diſpoſed to admit theſe ſtrangers, receiv'd them very ill; I had room to believe they would be all maſſacred. This is certain, that they had ſcarcely introduced themſelves, when there was a conſiderable humming heard in the hive, a proof, that every thing was in great commotion there. This hive was like thoſe towns ſurprized by a raſh but too feeble enemy, who feel by a haſty flight, what their temerity deſerved. Immediately I ſaw Bees either dead or dying, which other Bees brought out of the hive. The field of battle, and the places adjacent, offered nothing to the ſight, but ſcenes of death. After an hour and a half, the time, at which the Bees of the little hive took it into their head to make themſelves maſters of the great one, until five in the evening, the ſlaughter was

was great, and presented me with a spectacle as much diversified as mortal. Sometimes I saw two Bees proceed from the hive, one of which was drawn by the other, who seized it wherever it could, and try'd to mount upon its body; when it was fixed there, it seized the conquered Bee by the neck, and strangled it with its teeth; I say teeth, even in the literal sense. When the vanquish'd Bee had been bit, and grip'd near the anterior part of the body, she was dead, or dying: the victor left it lifeless in the dust, or ready to expire there: then she abandoned it, but continued settled near her, as if to enjoy her victory, in rubbing itself with its two hind legs, as a man rubs his hands, when he has done something, with which he is satisfied. At other times I have seen them come out of their hive, holding the vanquished Bee under their belly, and conveying the dead far off; other Bees drew those, who were expiring, from the hive, and cruelly dispatched them before my eyes.

CLAR. These are, I own, base, little animals; their murdering, quarrelsome, insolent humour hath given me so great a dislike to them, that, if it was not for their wax, which I have occasion for, I think I should immediately turn them out of my house.

EUGEN. Their wax ought to be no motive. Do you believe, Clarissa, you who value yourself on a most exact justice, that it would be permitted you to keep servants of a bad example, because you draw advantage from them?

CLAR.

CLAR. Good! I ſee your malice. You would fill my head with ſcruples, that I may loſe my wax. Let us put off to another time the deciſion of this caſe of conſcience; when we ſhall ſee, whether your maxim, which is true from man to man, is to be applied from man to brute. Let us, at preſent, think the time is paſt, which we allotted for our converſation.

EUGEN. I even think, that we have gone beyond it, and that I have broke into the regularity of your employments. I will add one word more, which will, probably, bring us to the door of your apartment. We muſt not confound theſe combats with another ſort of quarrel, which never ends in death. I have often ſeen three or four Bees after one; they ſeized her by the leg, each Bee on his own ſide, they dragg'd her, harraſs'd her, ſometimes bit her body or her corcelet. I own, at firſt, I had pity on the unhappy wretch, who was attacked with ſo much cowardice, and ſuch ſuperiority of numbers; but when I obſerved the Bee, thus attacked by ſo many enemies, had an eaſy method to free herſelf from them, I underſtood they had no deſign on its life. The combat was at an end, when the creature, thus bit and tormented, put out its trunk: for immediately one of the aggreſſors came to ſuck it, by applying to it its own trunk, as did the others in their turn; ſo that all theſe Bees ſeemed to have no other end in their attack, than to force her to diſgorge the honey, which ſhe had refuſed them.

CLAR.

CLAR. Misfortune on misfortune! 'Tis not enough then, that they commit treaſon, and engage in the moſt deſtructive war, but they muſt tear the bread from each others mouths. Are theſe the animals, of whoſe praiſes, the antients and the moderns have been ſo laviſh? theſe the people, which your Virgil has ſung in ſuch tuneful verſe? I ſhould have been as well pleaſed, if he had celebrated the Caraibs and the Anthrophagi.

EUGEN. I have already told you, that the antients were in the wrong, to praiſe them without bounds, and Virgil among the reſt. They were all of them but badly informed. We have now ſeen one part of what we have to reproach them with, ſuppoſing them free agents. Now we are going to take a view of what they have of good, admirable, and by ſo much the more admirable, as we would deprive them of intelligence, and reduce them to pure mechaniſm. You will find their bad qualities compenſated by their good ones. To convince you of it, we need only give a detail of their birth, labour, induſtry and politicks. And to give to their hiſtory a ſuitable order, we will begin, in our next converſation, to ſpeak of the fruitfulneſs of our Mother-bee, the preliminaries thereof; and, at the ſame time, will give you inconteſtable proofs of the ſex of the three ſpecies of Bees.

CON-

CONVERSATION V.

Of the generation of Bees, and the fruitfulneſs of the Mother-bee.

CLARISSA.

WOULD you perſuade me then, that no animal proceeds from corruption?

EUGEN. Yes, doubtleſs, I would perſwade you to it; and ſee you renounce for good this old error, which ſubſiſts only among the populace, and which men of true learning have baniſhed for ever.

CLAR. It is becauſe it is old and out of doors, that I chuſe to protect it.

EUGEN. Prodigious generoſity!

CLAR. Pleaſantry apart, I believe this change of opinion is not owing to the preſent mode. Tell me, from whence proceed thoſe worms, which ſpring from foods long kept, from ſtanding waters, from cheeſe, and from ſtuffs locked up in cheſts?

EUGEN. From a father and mother, as we do.

CLAR. You kill me! What will you pretend, that a worm, in a very hard and well cloſed nut, was generated there by its father and mother?

EUGEN.

EUGEN. No doubt of it. Only allow generation to be the cauſe of inſects; it is a fact now owned for true and capable of proof: it is a ſubject I ſhall not pretend to maintain in its utmoſt extent. I ſhall only ſpeak of our Bees; and endeavour to give you the moſt juſt ideas of their birth. But as before men ſow good grain, they are accuſtomed to root out pernicious weeds; ſo before I acquaint you with the generation of Bees, it is neceſſary to inform you, what they have believed, and what they ought to believe no longer. I am going to ſet before you the opinion of the antients; afterwards I will inform you what we ought to adhere to. The antients, who treated inſects as imperfect and contemptible animals, granted them, at the ſame time, a prerogative, which, had it been true, would have raiſed them far above us: that was, to be produced two different ways, of generation and corruption. They believed in the firſt caſe, the ſperme ought to be fecundated by the male; and in the other, a certain plaſtic virtue, the effect of corruption, or rather the child of their own imagination, was to them inſtead of father and mother. The privilege of this double birth was granted principally to flies. They had ſeen flies coupled together; they had likewiſe ſeen them proceed, if I may ſo ſay, from the boſom of matter, as thoſe which owe their birth to ſtagnating water, which proceed from the galls of trees, or from thoſe nuts, of which you juſt now ſpoke to me, or from ſtuffs locked up in cheſts.

They never gave themſeves the trouble to obſerve their eggs had not been laid there. They ſuppoſed that to be true, which they but ill obſerv'd, which but too often happens. On this a ſyſtem was form'd, which could not fail of being ridiculous. They pretended, that from a bull's corrupted fleſh were produc'd Bees: That a lyon, in a ſtate of corruption, furniſhed the moſt courageous, as thoſe, which owed their origin to a cow, were more gentle and tractable: That a meer calf could only furniſh very languid ones. They aſcribed to a dead horſe the privilege of engendring waſps and hornets; to an aſs that of beetles, and to certain trees the production of other inſects. They at laſt proceed ſo far, as to give to dirt and mud an engendring faculty. I am aſtoniſh'd, that they did not ſay all at once, that an ox might ſpring from a cock of putrid hay, a ſtag from the leaves of trees, a wolf from dead fleſh: It would not have coſt them any thing more.

CLAR. You are in a paſſion, Eugenio, againſt the antients: If they did not ſay ſo, it was certainly, becauſe they were aware of the abſurdity.

EUGEN. This I doubt of; ſince they have ſaid ſtill more. The Egyptians, in thoſe golden ages, when arts and ſciences flouriſh'd among them, did they not pretend, that their anceſtors ſprung immediately from the mud of the Nile? But to keep only to our Bees; has not Ariſtotle told us, that it was an opinon generally followed

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in his time, that Bees produced neither eggs, nor maggots? 'Tis the ſame, which Virgil has preferr'd; he tells us they diſdain the pleaſures of love, and that the pains of production are to them unknown; that it is from plants they gather their young. Some have told us, that they went to ſearch upon flowers a certain matter they carried to their hives, which, after having been made proper to become a ſeed, would produce maggots, which in time would turn into Bees. Diſputes likewiſe have been raiſed, from what kind of plant the Bees collected this wonderful matter. Some would have it was from the flowers of cerinthus, which is our balm, others from olive trees, and others again from a kind of reed.

CLAR. This is too much for once: I give up the antients. To ſeek for infants ready made from trees! I ſhould never have ſuſpected them to have carried their ſyſtem of the generation of inſects to ſo childiſh an abſurdity.

EUGEN. If the philoſophers have made great advancements, when they were in a right way, they have made as great when they loſt themſelves. But at laſt the time was come, in which, for the preſervation of reaſon, this liberty of imagination ought to be curb'd. Deſcartes put a ſtop to its impetuoſity, in ſhewing us how to examine the moſt received ideas, and, of them, to adopt none, which were not clear and evident. Could you, at this time, be of the ſentiment of Alexander of Montfort, who, in his book of *The ſpring-time of Bees*, ſays, the king is form'd

from a juice, which the Bees extract from flowers: That the ordinary Bees are ſometimes produc'd from honey, ſometimes from gum.

CLAR. You inſenſibly condemn my favourite author. Liger, in *his Country-houſe*, which I conſider as an abridgment of all good houſewifery there, tells us "In order to make Bees "by art, one has nothing to do but to kill an "ox in the ſummer, to ſhut it up in a well-"clos'd chamber, and to leave it to corrupt there "in its ſkin; at the end of forty-five days, "there will proceed from it an infinity of Bees." Does not this opinion in an author I like, and have a confidence in, merit ſome favour from you?

EUGEN. Pay no complaiſance to any bad reaſonings; of which there will always be too much in the world. That is not the only old-woman's tale one reads in that book. Let us put another fable, related by the ſame writer, upon the ſubject of the generation of Bees, on the ſame foot. He tells you, that to procure ſilk-worms by art, you muſt feed a cow with young with mulberry-leaves, 'till ſhe has calv'd, and continue to feed her and the calf likewiſe with the ſame leaves; "At laſt, ſays he, cut "the calf into pieces, without taking any thing "off of her, not even the hoof of her feet, ex-"poſe the ſame to be corrupted by the air, in a "granary; from thence will iſſue forth true "ſilk-worms." I have all my life admir'd with

with what eaſe people ſwallow fables, as well to relate as to believe them.

CLAR. You open my eyes, and I begin to be more and more ſenſible of the folly of theſe ſyſtems. How can there then, at this time of day, be people, who call themſelves philoſophers, and who, notwithſtanding, are ſo fond of theſe old opinions?

EUGEN. 'Tis becauſe truth is a ſun, which ſhines not to all the world; every body, that wou'd, can't ſee it. There are ſome perſons, over whom their prejudices domineer ſo much, and ſo ſurmounted with thick darkneſs, that the light cannot pierce through them. We have an inſtance of it in a book printed at Paris in 1720, where the Author, who otherwiſe lays down very good rules for the management of Bees, has ſubjoin'd a diſſertation upon their production, in which he pretends to eſtabliſh, by reaſons and obſervations, that the crude wax, which the Bees bring home on their legs, becomes vivified in the hive: That as the maggots of certain flies ('tis his own compariſon) ſpring from putrid fleſh, ſo the maggots, which are to become Bees, take their birth from this wax, which the warmth of the hive had corrupted. This author tells his ſtory, as if he himſelf had been an eye-witneſs of it.

CLAR. You prove to me, what I have often heard, that the hiſtory of the progreſs of ſciences is, at the ſame time, the hiſtory of errors, and, one may ſay, of the extravagancies of the human underſtanding.

EUGEN. That is what ought to make the progreſs of ſcience very dear, and very deſirable to us, ſince its only aim is to introduce truth, and to reaſon wiſe and circumſpect. There has not been more agreement about the ſex of Bees, than their generation. Some have thought, that the kings were males, others that they were females; ſome have regarded only the common Bees as males, others as ſo many females. Others have pretended, that they mutually coupled together. An Engliſh author, one Butler, in his *Female Monarchy*, is among thoſe, who would have it, that queens produce queens, and common Bees are the mothers of common Bees. He makes the drones produc'd from ordinary Bees. Others have conſider'd theſe drones as contributing nothing to the generation of Bees in a hive; others, on the contrary, will have it, they are females. Some have even thought, that the kings have ow'd their birth to the drones: whereas Pliny makes theſe drones imperfect Bees, produced by others, who are ſuperannuated. In ſhort, theſe different accounts, with regard to the ſex or the no ſex of Bees have been made, and they have all found their abettors.

CLAR. I am no longer ſurpriz'd at it. When one has not truth for one's guide, all paths appear right.

EUGEN. As for us, laying aſide all theſe different ſentiments, which thwart and deſtroy each other, let us keep nature in view, as far as ſhe permits us. I have had a perfect view of the

the generation of Bees, and can give you an account of it. I will tell nothing but what has paſſed under my eyes, and through my hands, nothing which you may not ſee here, at leaſt in part, if fortune favours us. Before I relate how and by what means they are produc'd, I ought as an exact and faithful hiſtorian, firſt to treat of what regards their common mother, what puts her in a condition ſolely to produce a numerous people, to the numbers of thirty or forty thouſand in a year. Towards the middle of May or the beginning of June, when a new ſwarm quits the hive it was born in, to look in the trunk of a tree, or ſome empty hive, a more commodious habitation; this new ſwarm is then compos'd of one queen at leaſt, of a number of drones or males, which march by hundreds, and of working Bees, which move by ſeveral thouſands. Scarcely has the colony arrived at its new habitation, when the working Bees labour with the utmoſt diligence, ſome to build the alveoli, others to ſeek materials neceſſary for life and building. There is no time to loſe, lodging muſt be had; they muſt immediately provide for their new eſtabliſhment. Sometimes in leſs than four and twenty hours they have made combs, more than twenty inches long, and between ſeven or eight wide: Thus one ſwarm makes more wax in the firſt fifteen days, than they do in all the reſt of the year. In the firſt days, every one beſtirs itſelf, with ardour, to thoſe labours, for which nature has intended it: The working Bees for

the gathering of honey and wax, for the publick edifices; the queen, to give ſucceſſors to theſe new inhabitants, which they are incapable of giving to themſelves. There are only the drones, who have nothing elſe to do, but to wait the good pleaſure of the queen.

CLAR. This ſeems to me to be a very humbling office for the males.

EUGEN. It muſt be own'd, that among the Bees, the males make no diſtinguiſh'd figure. I have told you, that when a new ſwarm takes the fields, it takes along with it one queen at leaſt, that is as much as to ſay, that there are ſometimes two, three, four, and even more. If there is none, the ſwarm will never ſettle; if, as it often happens, there are many, that too is a great inconvenience; but in this caſe the ſupernumerary queens only loſe their lives: For, to eſtabliſh the good and peace of the monarchy, there requires but one; the reſt are put to death. I will inform you of this maſſacre, as we go on. The remaining queſtion is, to know how this queen behaves to become a mother; how ſhe acts with her hundreds of husbands; how ſhe conducts in her numerous ſeraglio?

CLAR. I impatiently expect the particulars; I imagine the gallant anecdotes of the Mother-Bee would make a very entertaining hiſtory. Having examined, as you have often done, theſe with ſo penetrating an eye, I make no doubt you have ſurpriz'd the queen throwing her handkerchief.

EUGEN.

EUGEN. You have room, however, to doubt of it: For it is in this ſeraglio, as in that of the Orientals, there are none but the ſovereign and the ſervants of it, who can know what paſſes within. I have tried all ſorts of methods to penetrate into that of the Bees, and to diſcover its myſteries: they have always been religiouſly concealed from me, becauſe it is in the bottom of the hive, that this queen performs the deſigns of nature. Perhaps you think, that ſhame and modeſty engage her thus to hide herſelf. There is nothing of that; and you will ſee by and by, that ſhame is a virtue, which was given her gratis by the antients; and that ſhe leſs deſerves to be praiſed on that ſcore, than any animal I am acquainted with. I can't then tell you, if, amongſt this great number of males, one only is worthy to be honour'd with the queen's favours, or if many have a ſhare in her good graces. I am entirely ignorant of this, and don't at all attempt to gueſs; but that which I know for certain is, that ſhe demeans herſelf for the propagation of her ſpecies after the ſame manner, and by the ſame methods, that other animals do. I procur'd a proof of this, by no means equivocal. I had, for this, recourſe to two very ſimple expedients. The firſt is anatomy, which gave me a view of the interior parts, as well of the females, as the males, compared with thoſe of the Working-bees. The ſecond is the method I found out, to oblige the Mother-bee to ſubmit herſelf before me, and with my own eyes ſaw

her perform the duties, which nature requires of her; and to act, in my preſence, with one ſpouſe taken at random, what ſhe does with one, or more, of her own chooſing. I will begin with the anatomy, and will make it before you, that you may have no doubt or ſcruple, on that account. Don't you ſee this? It is a pregnant queen, which was ready to lay, and perhaps did ſo, when ſhe was taken and ſtrangled.

CLAR. From whence comes, Eugenius, this Mother-bee? How did you catch her?

EUGEN. I conceal'd her, to give you the pleaſure of a ſurprize. I yeſterday communicated to your gardener the ſecret of catching the Mother-bee. It is true, this ſecret has coſt you a whole hive: But I would have this queen, to prove to you the inconteſtable marks of her ſex; to let you ſee, that this king of the antients is a queen, and the more ſo for her fecundity. Let us now open anatomically the belly of this here, and obſerve what will firſt preſent itſelf. Aſſiſt your ſight with my glaſs, and judge.

CLAR. It is not at all doubtful. What a prodigious number of eggs! It is pretty ſtrange, that when it is ſo eaſy to know the ſex of a Bee, men have, for ſo many ages, reaſon'd wrong, on a fact ſo very obvious. Was it that there was no anatomy in Ariſtotle's time? A moderate ſight ſuffices; even your glaſs is of no ſervice.

EUGEN. The antients liked arguments better than experiments. A perſon diſtinguiſhed himſelf

himſelf in their times, by reaſoning true or falſe; but men are now diſtinguiſh'd by experiments. 'Tis in purſuance of this maxim of the moderns, that Swammerdam has given us a very good cut of theſe eggs, or rather of theſe *ovaria*; for that is the name he has judiciouſly given to theſe two bundles of eggs. See here. I am going to give you a particular account of them. The *ovarium* for a Bee is a collection of veſſels; for all theſe eggs, that you ſee in ſo great a number, were not placed there at random; they are contained in ſeveral inteſtines, or tranſparent bowels, of ſo great fineneſs, that they can't be perceived but by the means of a very good glaſs. I will now convince you of it. Take notice, that in raiſing with the point of a pin one thread of thoſe eggs, they don't ſeparate; but are continued from end to end. All theſe veſſels, which together compoſe the two bundles of diſtinct eggs, derive their origin from the ſame place, and terminate in the ſame common canal. When one opens a Mother-bee, when her laying time is far diſtant, as I have open'd many in the winter, and other ſeaſons of the year; you ſee nothing in the room of theſe *ovaria*, but bundles of threads finer than thoſe of a ſilk-worm. By means of a very good glaſs, one may however perceive ſome little inequalities, ſome little knots, which ſeem to end taper. But when the Bee, as this before us, is in her full laying time, her body ſeems to be filled with nothing but a prodigious number of different ſtrings of eggs, which

Plate V. Fig 1. Lett. aaa, &c. Lett. D. Lett. B. Lett. T E.

which reach from the upper part of the body quite down to the hinder. Obſerve, that theſe eggs, which are found in this lower part, near the common canal, are long, and ſuch as thoſe, which you'll find depoſited in the *alveoli* of the wax: and the more you trace them towards the top, the more they diminiſh, that is, they are leſs formed.

Plate V. Fig. 1. Lett. T E.

CLAR. Methinks I find a fault in this drawing of Swammerdam; all theſe ſtrings of eggs are collected and united, in one of theſe two *ovaria*, as they are in the Bee you hold; but in the other *ovarium* they are diſperſed.

Lett. E. Lett. C.

EUGEN. That is not a fault; 'twas the author's deſign in the graving. He intended, that one of theſe two *ovaria* ſhould give the idea of a mother ready to lay; and the other of one, at a farther diſtance from her time; and in this here, he has ſeparated the threads to render them more obvious. There are then the two *ovaria* well diſtinguiſhed. Let us now ſee the rout, which theſe eggs take, to come out. Theſe two great veſſels are conduits, into which the eggs fall at their leaving the *ovaria*; from thence they unite themſelves in this great canal, which Swammerdam conſiders as the matrix. This other ſpherical body, adhering to the matrix, is thought to contain the viſcous liquor, with which every egg ought to be lubricated, in falling from the body of the inſect, in order to be attached to the bottom of the *alveolus*. Theſe two great muſcles ſerve for the play of the ſting, and the bladder

Lett C. Letters T E, T E. Lett. m. Lett. o. Lett. n n n.

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of venom. Here is the veſſel, that conveys the venom into it. At laſt the dreadful ſting, curve, and greater than thoſe of the Working-bees, and the two parts, which ſerve it for a caſe. Lett. v. Lett. s. Lett. f. Lett. p p.

CLAR. What is the uſe of that great bladder I perceive between the two *ovaria?* Lett. x.

EUGEN. Swammerdam looks upon it as the pulmonary bladder, which, in this animal, performs the office of lungs, that is, a reſervoir of air, which in the Bees compreſs or dilates according as it needs.

CLAR. Although this anatomy is very well executed, very delicate and ingenious, yet I doubt, whether it would fully ſatisfy thoſe women, who would be more curious than I am, and deſirous of knowing more.

EUGEN. I am apprized of what theſe curious ladies would know with regard to anatomy: If they were here, I would tell them, in order to make nicer diſcoveries, they muſt have recourſe to analogy. 'Tis likely it is with the Bee, as with the female butterfly. Malphigi has very well diſcovered and deſcribed what I mean. He pretends to have found, in a female butterfly, a veſicula in the form of a pearl, and that this pearl is a reſervoir, which contains the fecundifying matter, which the male had depoſited: that this matter is conveyed into the *ovarium* by a canal of communication: that, when there, it moiſtens the eggs, and vivifies them as they paſs the *ovarium*: and that without this precaution, the

the eggs would be laid unfruitful, as thoſe of hens, which lay without the interpoſition of a cock.

CLAR. You have ſuppoſed in me a deſire of knowing that, which, perhaps, I have not. You are lucky, that I am not diſpoſed to quarrel. As to the diſcovery, it appears to me one of great penetration, and gives me a very high idea of the ſagacity of this Malphigi. So that I make no doubt, but he has carried his enquiries ſo far, as to count how many eggs there are in the belly of a Bee.

EUGEN. It is not him, 'tis Swammerdam, who is not at all inferior to him, who has undertaken the calculation. His eſtimation is, that each *ovarium* has more than a hundred and fifty veſſels deſtin'd to contain the eggs: that each veſſel contained ſeventeen eggs, which are viſible; and conſequently that the two *ovaria* of a Mother-Bee, ready to lay, contain five thouſand one hundred viſible eggs. This being ſo, one will have no difficulty to believe, that a Bee may produce, in ſeven or eight weeks, ten or twelve thouſand Bees or more; for one eaſily conceives, that the number of thoſe, which are not viſible, which will grow large, during the time the others will be laid, and which take their place in the *ovaria*; that the number of theſe eggs, I ſay, which eſcape our ſight, on account of their ſmallneſs, are by far ſuperior to thoſe other. After having ſhewn and proved to you, undeniably, as I ſuppoſe, that the Queen-bee is a very fruitful

mother; we muſt now let you ſee, that the drones are the males, and that the Working-bees are of no ſex: that they hold in this ſeraglio the ſame place, that the black eunuchs do, in that of the ſovereigns of Aſia: that they are only there as domeſticks, deſtin'd to all the work within doors; but are excluded from the privilege of repairing thoſe chaſms, which death makes every day in the ſtate. To have a full and entire conviction with regard to theſe drones, I am going to ſeize one, open it before you, and by the compariſon I will enable you to make of their interior parts, with thoſe of the Mother-bee, you will be a judge of the demonſtration of our proofs. If the examination of the interior parts of a Mother-bee has been ſufficient to let us ſee, that ſhe alone was able to give being to ſo many thouſand Bees, who are born every year in one hive, the examination of the interior parts of the drones will not be leſs certain to convince us, that they are allotted to render the eggs fruitful, and that they are the males. When one has diſcovered, as I ſhall preſently, the interior parts of a drone's body, it will be found, that the cavity of it is almoſt wholly filled with veſſels, and reſervoirs, whoſe uſe ſerves only to prepare and contain the liquor, proper to vivify the eggs. The parts you ſee, which, with regard to the place where they are lodg'd, are of a conſiderable ſize, and which are whiter than milk, owe their colour to the liquor, which they contain. None of theſe parts bear any reſemblance to thoſe you have ſeen, Plate V. Fig. 2, 3.

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in the body of the female; nor will you see any likeness to them, in those of the Working-bees. I shall not enter into a farther detail on the subject of those parts. If fancy, or curiosity takes you to know them more exactly, I refer you to the author, who has furnished me with all my knowledge.

CLAR. I know as much, on this article, as I am desirous of knowing. Now open the body of a Working-bee, that I may have no doubt of the three different species.

Plate XI. Fig. 3. Lett. v. Lett. v. Lett. x.

EUGEN. Here is one. You see here the canal for aliments: a first stomach, which contains the honey: a second stomach, and the intestines filled with crude wax: but beyond this, you observe no part analagous to the *ovaria*, nor any thing, that resembles, or that one can even suspect to be eggs: moreover, you see no part, which has the appearance of being that of the males or drones.

CLAR. That is true. I shall however raise one objection. How are you sure, that there is in one hive one only female; that what you call drones, are all males; and that the Working-bees are, without exception, of neither sex: to conclude, that the Bees are all, each in their kind, such as you have open'd? It appears to me very difficult to verify this exactly.

EUGEN. The certainty of it is very simple and easy. You have only to devote, as I have done, an entire hive; to destroy all its people, either by smoak, or water, and then to examine every

every particular Bee: it is not even neceſſary to open them; 'twill ſuffice to preſs them between your two fingers: one can eaſily make the characteriſtic parts of the ſex appear in thoſe, which have any; and the default of that appearance will indicate thoſe, which have none.

CLAR. What poſſibility is there of reſiſting ſo great an evidence? After what I have ſeen, there is no room for diſpute; one muſt ſurrender.

EUGEN. To take advantage of the good diſpoſition you are in, I paſs to the recital of the Mother-bee's amours. A Mother-bee, who is the only one of her ſex found in the hive, as ſhe is at certain times found there, with ſeven or eight hundred, and ſometimes a thouſand drones, ſeems to be there in the midſt of a very numerous ſeraglio of males. They have however pretended, that ſhe admits none of them to any intimacies with her. It is true, that, hitherto, no perſon has ſeen her ſeek their union, or, at leaſt, no perſon has writ, that he has ſeen it. But this is one of thoſe caſes, wherein a negative proof cannot have much force: for without aſcribing modeſty to this Bee, there is no reaſon to imagine, that ſhe quits the interior part of the hive, where ſhe likes to paſs her time, and that ſhe endeavours to expoſe herſelf to the ſpectators eyes, when ſhe would permit a male to render her eggs fruitful. The queen of * Achem is in the ſame caſe with the queen of the Bees, that is, to have a ſeraglio of men at her command. If then one of thoſe travellers, who traverſe the world to

* Gemelli Carreri.

inſtruct themſelves in the manners and cuſtoms of different people, ſhould keep himſelf in the ſuburbs of the city of Achem, in hopes, that this queen will come to ſeek him in the fields, with ſome one of her favourites, to make him a ſpectator of what ſecrets paſs between them, he would, probably, wait a great while to no purpoſe: and if he ſhould take it in his head to conclude, that men attend this queen, like your ſmall Bologna dogs, only for the pleaſure of being look'd at, I fancy he would not find many readers ſo ſimple as to believe his relation. Let us make the ſame inference with reſpect to the Bees. We have it not in our power to be witneſſes of all their actions. Our eyes are not formed to ſee through their waxen combs, covered with ſeveral layers of common Bees. But we are certain, it is behind theſe combs, that the myſtery of fecundation is carried on. Being thus inſtructed of the place, where the operation is performed, nothing more remains, but to know the time and the manner. The time is eaſy to be known. At the beginning of ſpring, open a hive, you will not find there one ſingle male: from the middle of May to the end of June, you will find hundreds of them: from thence to the following ſpring you look for them in vain: the time therefore of fecundation can be no other, but when there are males, that is, about ſix weeks, taken in the months of May and June. With regard to the manner how things paſs to cauſe this fecundation, 'tis what I myſelf have

ſeen,

ſeen, and of which I will give you an exact account. I found the ſecret to force a Mother-bee to act before me, in the ſame manner as ſhe does in the bottom of her hive.

CLAR. Hold, Eugenio: your virtuoſi may have the liberty of ſeeing, what is improper for the ladies to hear.

EUGEN. There are ways of talking to the underſtanding, without ſhocking the ears; theſe ways I intend to make uſe of. Towards the beginning of May, I took a mother, who had already given birth to a great number of Bees, and who was going to give it to ſeveral more. I put her into one of thoſe glaſſes, which we make uſe of for powder, where I ſhut her up with ſeven or eight males. I was curious to obſerve how they would behave with her, or ſhe with them. They were taken from the ſame hive, and were ſome of her huſbands. They treated her, however, with an indifference I did not expect. Near upon two hours I left them together, in which time nothing paſſed between them: each continued on its own ſide, in a perfect inaction, as people, who would never be acquainted.

CLAR. It ſeems as if this experiment is not much to the advantage of what you would perſuade me to.

EUGEN. When one makes experiments of this nature, it is equally advantageous to know what makes them fail, as what ſucceed. This laſt did not ſucceed for the following reaſons. In order to get this Queen-bee, I had plunged

the whole hive into water, and, by this means, had taken out the queen almoſt drowned. Return'd therefore in ſo ſmall a time, from the gates of death, it is not at all to be wonder'd at, that ſhe had not thoſe paſſions, which are the effects of full and perfect health. Beſide, ſhe was in the middle of her laying time, when all animals of both ſexes, have no mutual deſires. Add to this, ſhe was not a young mother; the condition of her wings proved her age, as ours is known by the wrinkles on our foreheads: her wings were notched, and the edges of them ſhivered away. The obſervations I was deſirous of making demanded therefore, that I ſhould ſhut up with ſome males a female, which, as yet, had no communication, or very little with them. Towards the middle of June they brought me one, which I had reaſon to believe was ſuch as I wanted. She had been found, that morning, near a hive, which had ſwarmed the night before. For, as I have already told you, there are ſome times ſupernumerary queens amongſt the ſwarms: this I ſpeak of, was one of the ſwarm, who, 'tis likely, had ſaved her life by flight. The good condition of her wings, and her colour, made me conclude, that ſhe was yet young; and the bulk of her body, not ſo great as that of a female ready to lay, ſeemed to prove, that ſhe had no other eggs, but ſuch as were extreamly ſmall. I ſhut her up in the glaſs, where I put likewiſe a male with her, which I had ordered to be taken from one of my old hives. I diſcovered the character

racter of this young queen, as ſoon as ſhe had been put to the proof. I had never ſeen any but queens, accuſtomed to be treated, every inſtant, by the Working-bees, to receive from them preſents of honey, thouſands of careſſes, and a thouſand little marks of eſteem, of every kind. Thus I ſaw, with ſome ſurprize, that all the deference, which common Bees have for the mother, the ſame this young queen had for the drones, I had put to her. Not ſatisfied to come near him, ſhe delayed not to put out her trunk, ſometimes ſucceſſively to lick different parts of the male's body, at other times to offer him honey: ſhe turned round about him, continually careſſing him, either with her trunk or legs. The drone ſtupidly ſubmitted to ſo many indearments, as if they had been his due, nor ſeemed at all moved by them. It ſeemed, as if it had been goodneſs in him to ſuffer himſelf to be careſs'd: however, at the end of a quarter of an hour, he ſeemed to to be a little animated; and when the female, placed in ſight, full over againſt him, had bruſhed, with her thighs, the head of this inſenſible, and had ſoftly ſet at play her *antennæ*; the male was determined, at length, to anſwer her advances, by ſimilar ones, of the ſame nature. The female redoubled her vivacity, and placed herſelf in thoſe poſitions, which agree not very well with the idea which has been attempted to be given us of her modeſty: it is to make uſe of a weak term, to ſtile theſe poſitions only immodeſt; they approached to ſomething ſuperior, unknown to

us, a ſuperiority, which overthrows the genera order of nature, by ſubjecting the more noble ſpecies to the other. All theſe indearments were by no means unuſeful to this paſſionate queen; her indolent ſpouſe became more active; he was animated more and more. One might ſee, as I did diſtinctly, that many of thoſe organs, which you obſerved within him, when I open'd the male, appear'd without him. The whole tranſaction continued three or four hours, during which he found time for repoſe, and repeated acts of love. At length the drone fell into one, which to the queen ſeemed to be of too long a duration. She was deſirous to draw him from his lethargy; ſhe ſeized him, with her teeth, by the corcelet; ſhe cheer'd him a little; ſometimes, in order to refreſh him more, ſhe put her head under his body; but ſo many marks of her repeated regard were unuſeful; he was dead.

CLAR. How! what do you ſay?

EUGEN. I ſay he was dead, nor is he the only one I have ſeen expire in theſe critical moments. I fancy ſo immediate a death in ſuch circumſtances may appear to you ſuſpicious, or, at leaſt, an extraordinary event, but the conſequences were ſo. When I knew this little animal was abſolutely depriv'd of life, I only thought of conſoling the widow, and I fancied I could not better ſucceed in this, than to preſent her another ſpouſe young and vigorous.

CLAR.

CLAR. That is to ſay, that you reaſon'd on the account of this Bee, agreeably to the malicious principles, which men are poſſeſs'd with in regard to our ſex. Could a philoſopher of your caſt have any taint of vulgar prejudices?

EUGEN. Grant me more juſtice. I thought of no inference injurious to the ladies; I was only deſirous to treat this Bee like a brute; but to my great aſtoniſhment, ſhe behav'd like a virtuous wife. The living did not at all conſole her for the dead. She remain'd all the reſt of the day fix'd to the body of her unfortunate ſpouſe, continuing the ſame cares, and loading him with the ſame careſſes, which ſhe had conferred during life. The widow of Mauſolus could not better diſcharge her duty.

CLAR. You begin to intereſt me for this tender queen. I am curious to know her deſtiny.

EUGEN. You ſhall ſoon be ſatisfied; night being come, I drew from the glaſs the two ſpouſes, the living and the dead, and ſhut up in their room a hundred common Bees, to keep our queen warm, during the night. The next morning, I preſented her with a new huſband. I beſtowed likewiſe another on another queen, which they had brought me to repeat the experiment. The two females behaved in the ſame manner, in which the firſt had done the day before with a male in perfect health.

CLAR. This ſpoils all. Was then one night ſufficient to cauſe your Artemiſia to forget her Mauſolus?

EUGEN. What is approv'd among us, let us not charge as a crime to her. We find nothing blameable, that a young widow ſhould admit new engagements, after her year of widowhood. One night with a Bee may be equivalent to one of our years. Time ought to be meaſur'd according to the duration of life. An animal, which has but three or or four years to live, cannot admit ſo long interval between two actions, as that, which has ſixty or ſeventy. Beſides, from all you have ſeen, and from all I have told you, we have a right to conclude that, in the hive the Mother-bee acts as that did in the glaſs; and, conſequently, that Bees are produced like other animals, and not from corruption.

CLAR. That appears to me extreamly true. But I think it no leſs ſtrange, that this queen ſhould gratify the deſires of her ſex, in a manner ſo oppoſite to natural order.

EUGEN. This inverſion of nature ought not to ſurprize you; it is even neceſſary in this caſe: For when it has been once eſtabliſh'd, that a female ſhould cohabit with a thouſand males, the conſequence ought to be, that theſe males ſhould be ſleepy, and to be awaked only by her; that ſhe ſhould be free to chuſe among them all him, whom ſhe would honour with her favours. You eaſily conceive what confuſion, what a terrible ſituation it would be for a woman, to find herſelf in the midſt and at the mercy of a crowd of active, petulant huſbands, who would all be maſters the ſame moment.

CLAR.

CLAR. You are in the right; that is eaſily admitted. The imagination requires no aſſiſtance, to preſent to itſelf a juſt image of the diſorders, which would reſult from thence.

EUGEN. You now know, Clariſſa, how the Mother-bee becomes fruitful; you know what puts her in a ſtate to people the world with ſo numerous a poſterity. We ſhall ſee the next time we meet here, how ſhe acquits herſelf of this important and laborious office. That is, we will talk of her laying, and, on that occaſion, of the homage and reſpects, which are paid her by the other Bees.

CON-

CONVERSATION VI.

Of the Mother-bee's laying her eggs, and the homage paid her.

EUGENIO.

I Congratulate myself, Clariſſa, on ſhewing you, this day, the manner of the Mother-bee's laying her eggs, and, it may be, in giving you a ſight of her. The ſeaſon being favourable (for the ſtrongeſt time of her laying falls out about the end of May, and the beginning of the next month) I hope we ſhall take the queen in the fact, and meet her, while ſhe goes from cell to cell, planting an egg in each, and ſowing, as I may call it, her poſterity. This is an operation of great importance: 'Tis not the queen only, that is intereſted; it concerns the whole hive; 'tis the affair of the whole people, and the ſafety of the ſtate.

CLAR. Though the birth of the Dauphin were the ſubject, you could not make uſe of more emphatic words.

EUGEN. The parity is with regard to the public intereſt, but in reality, the difference in fact is very great. In the laſt caſe, queens give but one ſucceſſor to the head of the empire; in the other, the Queen-bee ought to produce a whole people together with their head.

CLAR.

CLAR. That is, that ſhe lays both the monarch and monarchy.

EUGEN. That is exactly true. Call to mind what I have already told you, that when a ſwarm with a queen at their head, falls upon an empty hive, the Working-bees, that inſtant, apply themſelves to labour; that they have nothing more at heart than building their *alveoli*; that they engage in this work with zeal and a prodigious activity: A comb of wax, twenty inches long, and ſeven or eight wide, is the work of four and twenty hours. Their principal aim is not only to have cells, in which they may depoſite their honey, which makes them then redouble their activity; a ſtronger motive ſeems to animate them; they ſeem to know, that their queen is in haſte to lay her eggs, and that one cell is neceſſary for each particular one. I will not, at this time, deſcribe to you, the manner, in which the Bees build their cells or *alveoli*; that ſhall be an ample ſubject of entertainment for another day. Let us ſatisfy ourſelves now, to ſee through this glaſs hive, a Mother-bee in that office, which diſtinguiſhes the females from the males.

CLAR. What do I ſee, Eugenio? Our hive is in a very different ſtate from what it was three days ago. It ſeems to be only a hive begun, whereas it was, in our laſt converſation, an old one and well ſtock'd. Has any misfortune happen'd to it?

EUGEN.

EUGEN. I was the author of all the miſchief. The laſt time we parted, I went to prepare that hive for the deſign I had form'd, which was to give you a ſight of the Mother-bee laying her eggs. To accompliſh that, I caus'd all the Bees, which were in this, to paſs into another hive, by means of ſmoke. I took out the combs, and after I had clean'd and perfum'd the inſide, I preſented it to a young ſwarm, which was in the fields, and in queſt for lodging; theſe made no great difficulty to enter. Scarcely have paſſed twice four and twenty hours, ſince the ſwarm has been lodg'd in this hive, and ſince it has been at work here, and, probably, the queen lodg'd ſome eggs. Let us ſtoop down near this glaſs ſquare, and fix our ſight on theſe new combs, which are not yet in ſufficient number for one to obſcure the other. I make no doubt but, with a little patience, we ſhall ſee the queen enter into theſe empty cells, which you find before you, and of which the greateſt number is deſtin'd for eggs.

CLAR. I ſhall keep my eye upon them. But as we have nothing to do, and wait for a ſight of this queen, I will beg the ſolution of a difficulty, which embarraſſes me. This ſwarm, which we now ſee at work, and which has not quitted its hive, wherein it received its birth above two days, and which cannot date its exiſtence but a little time before; how is it the iſſue of the queen's body, who, in all appearance, was born at the ſame time with it? How can

one

one ſay, that this queen is the mother of her people?

EUGEN. We ought not to ſay ſo at preſent. This is not the time to make uſe of this expreſſion. To give you a juſter notion, you muſt know, that a hive is a continued circle of living and dead Bees. As we ought to fix a point to this circle, to trace the life of this people from their birth to their death, I ſet out from a ſwarm, that is, from the departure of a colony to found a new hive. This date appears to me the moſt commodious. The Bees deſtin'd for this tranſmigration are not only thoſe, which were laſt born; there are ſome old ones too, which mix themſelves with the new ones: one part is of the preceeding year, another part, as you obſerv'd, began to exiſt but a few days before. But the queen is always one of theſe laſt, and by conſequence a young mother. When the Romans ſent out colonies to repeople thoſe countries, which they had ravag'd; they were compoſed of people of all ages, to the end that by the vivacity of the young, temper'd by the prudence and caution of the old, there ſhould reſult a ſpirit of wiſdom, vigilance and good government.

CLAR. You hurry on the relation of a fact, which I find a little difficult to believe. You thought, perhaps, that in embelliſhing it, with a fine compariſon, I ſhould not ſo nearly attend to it. However it appears difficult, that you ſhould be able to diſtinguiſh ſo nicely the different ages of Bees, thoſe of the laſt year and thoſe of this.

All that I ſee, ſeem to me to be alike. I don't ſuppoſe, that you would have me underſtand, that you know how to diſtinguiſh the traces and wrinkles, which time impreſſes on the features of a Bee.

EUGEN. Pardon me. That is nearly what I would ſay. I have promis'd you, Clariſſa, that I would tell you nothing falſe, would exaggerate nothing, with regard to facts: as to the expreſſion, I afford myſelf a little more licence. You know me ſufficiently to take my promiſe as a ſure warrant for the truth of my recitals. If the experiments and obſervations, on which facts are founded, were a delicate ſort of legerdemain, which depended on a ſlight of hand, the twinkling of an eye, a ſwift and rapid moment of time, you would have a proper foundation, not to truſt me without caution, and I myſelf ſhould not draw any conſequences, but with the greateſt circumſpection. But theſe, which I have made on the Bees are ſo evident, and I may ſay ſo palpable, that it would be but an ill-plac'd merit to ſpeak of them with timidity. Whoever has been accuſtom'd to ſee the Bees of the preſent year, and thoſe of the preceding, well knows, that the firſt are brown, and have white hair, and the other their hair red, and their wings leſs brown: theſe colours are peculiar to different ages. Among thoſe, who put themſelves in the train of a new queen, one obſerves theſe two colours, and the different ſhades, that are between them. Join to this obſervation that of the ſtate

of

of their wings, which are found and intire in youth, and which, in more advanced age, are broken and notch'd through hard ſervice. To conclude, if thoſe, which remain in the old hive, are examined, one there obſerves ſome young, ſome old, and ſome of a middle age. The ſwarm then is compoſed of Bees of all ages, and there remain thoſe of every age in the hive. Thoſe, which happen to be at the door when the queen takes her leave, fly along with her, and compoſe that troop form'd by chance, which we call a ſwarm.

CLAR. One muſt ſay then, according to you, to ſpeak with exactneſs, that a Mother-bee, which conducts her ſwarm abroad, is no more than their ſiſter; that ſhe is a young ſiſter, attended by elder and younger brothers, who all have one common mother, which they have left, in queſt of a more commodious habitation in a foreign country. That this queen will become a mother in her turn, and in her turn will likewiſe be abandoned by one part of her children, who will go elſewhere to ſeek their fortunes in diſincumbring the houſe.

EUGEN. You are perfectly right. You need only add, that before this laſt tranſmigration, and during the time the young queen multiplies, by a continual laying, the number of her ſubjects, ſo far as to oblige them to divide themſelves, ſhe may with juſtice be called the mother of her people; or, at leaſt, of that part of her people, which ſpring from her, in the ſame hive.

CLAR. O, Eugenio! is not that yonder the mother, ſo much expected, who advances in the middle of a croud of courtiers? Let's ſpeak low, for fear of frightning her.

EUGEN. No need to uſe this caution, for it is not ſhe. I cannot tell you, what this little groupe of Bees do there, which you took for the queen and her court; but I plainly ſee it is not her.

CLAR. That being ſo, to fill up the time, which will be loſt in ſilence, I am going to propoſe to you queſtions ſuitable to the preſent ſubject. This Bee, which we wait for with ſo much patience, and which actually lays at the bottom of the hive, does not, certainly, lay eggs unfruitful. What time has ſhe taken to give them life? Was it while ſhe was yet in her natal hive; or ſince her leaving that and ſettlement here? Was her marriage (to make uſe of that expreſſion) celebrated before ſhe had placed herſelf at the head of the troop, which ſhe ought to conduct abroad, or in the repoſe, which her new habitation gives her? In a word, what was her age, when ſhe commenc'd a mother?

EUGEN. A young mother is in a condition to lead a ſwarm from the hive, where ſhe was born, four or five days after ſhe has appear'd in it with wings; that is to ſay, after ſhe has quitted her nympha-ſtate (I ſhall explain to you ſome other time what that nympha-ſtate means) and when ſhe has reſolved on her journey, her eggs have been already fecundated. Thus, in the ſpace of four

four or five days, her ſex diſcovers itſelf, and ſhe makes uſe of it. I have a good many proofs, which concur to eſtabliſh this fact. I have found ſwarms, among which there was not ſo much as a ſingle male. In a hive, where a ſwarm has ſettled itſelf not more than four and twenty hours, I have frequently obſerved combs, in whoſe cells I have ſeen eggs.

CLAR. What do I ſee? What means this tumult? Is it the queen, who advances?

EUGEN. It may be her. Let us wait a moment——no it is not her.

CLAR. Let us then aſk queſtions, for it is in this manner, that I delight to inſtruct myſelf. I here ſee ſeveral *alveoli* but half formed, and as it were abandoned by the Bees; that to me has the appearance of wax put to bad purpoſe. Is it that joy for the queen's lying-in has turn'd the head of her little people? or do they forget, from time to time, that conſummate geometry you aſcribe to them?

EUGEN. That which you treat as an unfiniſh'd work, is one of the moſt admirable marks of foreſight, which our little animals give. There are ſome times, when they are in the utmoſt hurry of work, when they know their queen is in as great a hurry to lay. In this caſe they beſtow on their new cells but part of the depth they ought to have; they leave them imperfect, and defer the finiſhing of them, 'till they have traced out the number of thoſe, which are neceſſary for the time preſent. You do not ſee here the cells

of the drones, nor the royal cells. The reaſon is, that the Working-bees, which are of no ſex, ſeem to know what paſſes in the body of their ſovereign, and even what paſſes there as a conſequence of her ſex. They know, if ſhe is made fruitful, if her eggs will be numerous; they know ſhe will produce many thouſand workers like themſelves, ſeveral hundreds of males, and three or four, and ſometimes more than fifteen or twenty females: they know, that the females are larger than the males, the males bigger than the workers: that the queen will not lay any male eggs, 'till ſhe has produced a great number of workers; nor females, 'till after thoſe of the males. And as they are ſenſible of all this, they build *alveoli* proportionably to the number and ſize of the ſubjects, and according to the times, in which they are to be produced.

CLAR. You beſtow on them a pretty deal of ſcience.

EUGEN. I ſhall hereafter let you ſee, that one can't refuſe it to them.

CLAR. Ho, for once, ſee there ſhe is!

EUGEN. That is not ſhe yet. But in waiting till ſhe appears, I ſhall take notice of a word you juſt now mention'd, to remove an error of the antients. You aſk'd me, if it was joy for the queen's lying-in, that turn'd the head of theſe little people? Some authors have given us the time, in which the queen lays her eggs, for a time of feaſting and rejoicing, during which there is an abſolute vacation in the hive. They are

miſtaken.

miſtaken. If it was ſo, theſe little people would be very happy; joy would be almoſt always the conſequence. For this mother lays moſt months in the year. However, they would run a chance of being ſtarved to death, by indulging themſelves too much in joy. In the greateſt monarchies, while the queen gives a preſumptive heir to the ſtate, the artiſans are employed in their ſhops in their ordinary labours; the people know nothing of what paſſes of importance in the palace of the king, where he acts, as if he knew nothing of the matter. It is juſt the ſame in each monarchy of the Bees: the publick labours are not at all interrupted during the queen's laying her eggs: honey and materials for wax are brought to the hive; building and finiſhing their cells go on as uſual. Your patience, Clariſſa, will not be long put to the proof, for the queen, with all her train, advances this way. I leave you the pleaſure, to diſtinguiſh, by your ſelf, the various employments, in which the ſubjects of this little court engage themſelves.

CLAR. There ſhe is; I ſee her, this ſo much deſired queen, in the centre of ten or twelve Bees, who ſurround her. I know her by her bulk, her ſhort wings, which make her a kind of mantelet; I admire her gravity, and, as I may ſay, the majeſty, with which ſhe conducts her ſteps. She enters into a cell, where ſhe goes, no doubt, to depoſite an egg. Plate VI. Fig. 2.

EUGEN. She only enters for that purpose. But take notice it is at two different times, and in two different manners. She at first enters head foremost, and, after she has stay'd there some moments, she comes out again. She enters now, for the first time, in order to retire, which is to examine, if the cell be empty, clean, and that there be nothing, which may be hurtful to the precious depositum, which she is going to commit to it: the second time will be to lay her egg there.

CLAR. How, she comes out already! an egg then is soon deposited? It appears to me to be the work of a moment. See there she goes to another cell. Observe, Eugenio, how all these Bees place themselves in a circle round their queen; how they all have their heads turned towards her; how they contemplate her, and give her demonstrations with their trunk; one would say, that they endeavour to make their court, and render themselves agreeable to their sovereign; that they present to her their homage and respect.

Plate VI. Fig. 2.

EUGEN. One might say so, and I really believe we may truly say it.

CLAR. Ho, see what is more remarkable! There is one of them, that licks her; another which gently rubs and cleans her; this here presents her honey with the extremity of its trunk. Yet our queen advances not. Is she reposing herself?

Lett. A.

EUGEN.

EUGEN. 'Tis very likely, for ſhe commonly does ſo, after having laid five or ſix eggs together.

CLAR. Good! obſerve thoſe Bees, who redouble their zeal. There is one, that licks her extreameſt rings: hah! the little pretty animals! This is a charming ſight, and very ſenſibly touches me; for nothing affects me more, than the tender concern of children for their mother, or ſubjects towards their ſovereign. What I would deſire at preſent to know is, if theſe twelve Bees, which compoſe the court of the queen-mother, who follow her every where with ſo much love, are choſen by the queen, or deputed on the part of the people; or if they are the firſt, that offer themſelves, at the moment the queen lays, and whoſe office it is to exerciſe the chief employments of the crown.

EUGEN. That is what I ſhall not amuſe myſelf by gueſſing at, but inſtead of loſing ourſelves in theſe frivolous conjectures, let us endeavour to eradicate thoſe, which has been tranſmitted to us. It has been pretended, that the Bees made a curtain of their bodies, to cover the queen while ſhe was laying: that they were well apprized of what they had to ſuffer, if ſhe was not concealed, during an operation, which ought to be hid in darkneſs. To conclude, they were deſirous of honouring her all along with a virtue ſhe leſs deſerves than any animal. I have given you proofs of it, and you have juſt ſeen ſome effects of it.

CLAR. I will atteſt, whenever you pleaſe, that there is not, in nature, a little animal, more unedifying.

EUGEN. However, let us juſtify the antients as far as we can. One part of their miſtakes does not always riſe from their imagination, which endeavoured to divert itſelf, and amuſe us alſo with pretty tales: it often proceeded from objects ill ſeen, or from thoſe whoſe uſe was but ill gueſſed at. The praiſe of modeſty, which they were pleaſed to beſtow on Bees, took place from hence, that they had often ſeen them in groupes, as hanging in maſſes, or garland-wiſe: they took theſe maſſes of Bees for curtains, which concealed thoſe operations, which uſually paſs in the dark. But from whom would they conceal their queens? By whom would this queen commonly be ſeen, but by Bees ſimilar to thoſe, which would conceal her? In fine, if there was any indecency in a Bee to lay eggs, all this would be ſaved, when the part, from whence they proceed, is hid in the cell. There might happen to be Bees diſpoſed in the form of a curtain, whilſt the mother laid her eggs; but it is not becauſe ſhe laid, they are diſpoſed in this manner; it is to take their reſt, as you ſaw in our firſt converſation. Since we are upon the ſubject of careſſes and homages, which the Bees pay their queen, I muſt tell you all I know on this particular. Firſt of all, don't ſuppoſe, that the ſame ceremony always takes place, when the queen lays; that ſhe always has twelve Bees for her aſſiſtants;

that

that it is always the ſame, which preſents her with honey, that bruſhes, that licks her, &c. The ceremony is not ſo regulated, that it does not often change. I have ſometimes ſeen queens, ready to lay, which were not attended with more than four or five Bees. There are other occaſions, beſides thoſe of laying her eggs, in which the Bees pay to their queen their moſt tender devoirs; for example, in publick calamities. I will give you a relation touching one of theſe occaſions, of which I was both witneſs and author, and which gave me, at that time, a ſingular pleaſure. Willing to be certain, if there were two mothers in one ſwarm, I divided it into two parts, which I caus'd to enter into two different hives, which I kept near to receive them in. If this ſwarm had one mother, and but one, as 'tis frequently aſſerted, this mother muſt needs be found in one of my two hives, and not in the other; which accordingly happened. I was deſirous of ſeeing from this experiment, how the Bees, which have a queen, behave, and thoſe which have none. But this is not the ſubject at preſent. I will only inform you what paſſed with relation to the queen, in the midſt of the diſorder and confuſion, during her removal, and that of part of the ſwarm, from one hive into another. After having obſerved for about half a quarter of an hour the hive, in which the queen was, (you take for granted, that all thoſe hives, from whence I took my obſervation, were glazed on all ſides) and after the grand agitation of the

Bees, ſhut up with her, was a little calm'd, it was that very day, wherein for the firſt time I had ever ſeen a Queen-bee, who marched at the bottom of the hive with a ſlow pace, and was alone; ſhe ſeemed to me ſo neglected by the other, that I was tempted to conclude, all that had been ſaid of their court to her, and of the train, wherewith ſhe was atttended, was more the effect of imagination than obſervation. This deſerted queen therefore, continuing to walk alone, came to one of the glaſs-ſquares, along which ſhe mounted, to come to one of thoſe large maſſes of Bees, which had formed themſelves on the upper part. A little time after ſhe again ſhewed herſelf at the bottom, all this while being very much deſerted: after having been mounted a ſecond time, and concealed herſelf, during ſome moments, from my ſight, among a collection of Bees, ſhe returned a third time to the bottom. But then twelve or fifteen Bees ſurrounded her, and ſeemed to do ſo in order to compoſe her train. In the firſt attacks of any great trouble or confuſion, one thinks only for one's ſelf. Should any one find himſelf in a great hall, well filled with company, whoſe fall ſhould be ſudden and total, he would forget at that very inſtant, whatever was moſt dear. The Bees clapt tumultuouſly into a hive, which had been turned ſeveral ways, at ſeveral times, found themſelves in the like caſe. In the firſt moment each thought only of itſelf; but when they came to themſelves, they then begun to think of that mother they had either for-

gotten

gotten or neglected. The mother, with her little train, placed herſelf again among a cluſter of Bees, where ſhe diſappeared. She did not continue there long, without being ſeen again at the bottom. Scarce was ſhe come there, when about a dozen Bees attended her: others made haſte to advance towards her: theſe laſt placed themſelves on two files, on each ſide, while the mother continued her march; others, who met her, ſtill ſurrounded her. Her court every moment grew more numerous. Immediately a circle of more than thirty Bees was formed round her. The ranks of thoſe in front open'd, in proportion as was neceſſary to leave her a free paſſage. Some advanced nearer the queen than others, and licked her with their trunks. Others ſtretched out theirs, and in that manner preſented them to her, in offering honey. I ſometimes ſaw her ſtop to ſuck the offer'd nectar. Sometimes likewiſe, in her march, ſhe ſuck'd the trunk of ſome other Bee. All this behaviour laſted ſeveral hours, during which time, I frequently ſaw the Mother-bee, and always with a train, which ſeemed deſirous to confer honours or good offices upon her. In ſome caſes, however, this mother ſeemed a little neglected. But their cares and aſſiduities were ſo frequently paid her, that one ought to conſider as certain a great part of what has been affirmed concerning thoſe appearances of reſpect, which other Bees pay to their queen.

CLAR.

CLAR. What you ſay, and what I have ſeen, leave me no room to doubt of it: on the contrary it preſents me with a very pleaſing image. I ſtill think I ſee this queen majeſtick in her mantelet, in the pains of child-birth; ſurrounded with all her court-ladies, ſtirring to eaſe and comfort her under thoſe pains. I admired how one preſents her with a honey caudle, in what manner another combs and cleans her, and how others load her with kiſſes, try all means to pleaſe her, and, in fine, offer her their continual ſervices. But while I reaſon at random, behold our queen there, who again regales me with her preſence. She is going to enter, head foremoſt, into an *alveolus*, and after ſhe has left that, without depoſiting any thing, ſhe paſſes to another.

EUGEN. I have already prepoſſeſſed you upon the choice ſhe makes of the places deſtined to receive her eggs. The firſt viſit the queen makes to an *alveolus* is to examine it, to ſee if nothing be wanting there, if it is well made and clos'd, and if her eggs will be ſafe there. There is likewiſe another reaſon, which is well known to us, which makes her paſs by an empty cell, without ſtopping: it is when it is too large or too little for the egg, which ſhe is going to lay.

CLAR. Can they be too large or too little? You have repreſented to me theſe Bees as geometers of the firſt claſs, capable of reading lectures to your Newtons or Varignons: how can they be out in their meaſures?

EUGEN.

EUGEN. Have you already forgot, that three ſorts of *alveoli* are required in a hive, of which thoſe, that are the leaſt, are deſtin'd for the eggs of common Bees, thoſe, which are bigger, for the males, and the largeſt of all, and of a figure different from the reſt, for thoſe, which will turn out queens. The Bees don't give them theſe proportions at hazard. Theſe proportions have relation to the number and quantity of eggs, which their queen will lay; and the queen, on her part, to anſwer this foreſight, will not fail to place her eggs in cells correſpondent to their bulk: ſo that when ſhe perceives the egg ſhe is going to lay, is for a Working-bee, ſhe chuſes the leaſt cell; if it is for a drone, a larger; if for a female or a queen, ſhe carries it into one of thoſe grand *alveoli*, which I have repreſented as the palace of the queens.

CLAR. You give to our Mother-bee a knowledge, for which I ſhould have paid a good price, and that very willingly, in the firſt years of my marriage. You pretend ſhe knows, if what ſhe is going to produce, will be male or female, or a Bee of no ſex.

EUGEN. I make no doubt of it, ſince ſhe is never deceived in depoſiting her eggs in different places, convenient for them; ſince there is no ſaying ſhe is conducted thither by her eyes, nor any of her exterior ſenſes, we muſt, in ſpite of ourſelves, agree, that theſe Queen-bees have an inward ſenſe, by which they judge, and which is refus'd to us.

CLAR.

CLAR. Should we not have ſome pretext to complain of nature, which inſtructs ſo well a ſimple Bee, ſince ſhe leaves us ignorant of the ſex of the infant we are to bring into the world?

EUGEN. Brutes are favour'd with many other advantages, of which we ſhould have room to be jealous, if they were not all more than compenſated by one, that is peculiar to us, and which raiſes our condition to a rank far ſuperior to that of other beings: this advantage, this excluſive privilege is reaſon, which teaches us to know the Author of the bleſſings we enjoy, and to pay him our acknowledgments.

CLAR. You ſkip over the difficulty, in a Chriſtian like manner; one can't but be obliged to you for the favour of the inſtruction. Not to fatigue you with too long a converſation, I will reduce to one ſimple queſtion, what I now deſire to know of you with regard to this Mother-bee. How many eggs does ſhe lay in one day?

EUGEN. There are times, when ſhe paſſes ſome days, and without doubt many together, without laying: but it is not in ſpring time; for then is the height of her laying. I can't juſtly tell you the number of eggs, which ſhe emits when ſhe lays the moſt; but one may judge how many ſhe lays in that ſeaſon, and the calculation may be drawn from the number of Bees, of which a ſwarm is compoſed. Suppoſe a ſwarm born towards the end of March, and to take its flight about the twentieth or twenty-fifth of May.

Notwith-

Notwithſtanding their departure, the hive often remains as much or more peopled, than it was at the beginning of March. The ſwarm, without conſidering it as a robuſt one, may be compoſed of more than twenty thouſand Bees. The mother then has laid more than twelve thouſand eggs, in leſs than two months, ſuppoſing the two months compleat. If we take a medium, we divide by ſixty days the twelve thouſand eggs laid during the two months, and find the Mother-bee to have laid, every day, about two hundred. This prodigious fecundity is not only given to our Mother-bee; ſeveral inſects ſurpaſs her in that; but that of the Bee is attended with one ſingularity, that deſerves remark; it is, that the Bee keeps in her body, and for a long time, thoſe impregnated eggs, or (which better agrees with the diſcoveries of Malphigi, and cauſes the ſame effect) ſhe there, for ſeveral months, and without alteration, retains, I ſay, that living, penetrating matter, truſted with her by the male, and intended to enliven the eggs, at the time of their excluſion. Whichever of theſe two ſentiments is true, the ſame wonder ſubſiſts. You may remember I told you, that the males of one hive live but ſix weeks with the mother; that, after the expiration of that time, they are put to death without quarter. And yet the mother, who, from the month of June, has been deprived of all her males, fails not to produce ſeveral impregnated eggs, during the reſt of the ſummer, and the beginning of autumn: but the ſpring following,

lowing, and before the birth of the new drones, will chiefly be the time, that ſhe will lay eggs enough to furniſh a ſwarm. Theſe laſt eggs then ought to be impregnated, nine or ten months, before they were laid. It is very particular, that while theſe eggs, which are not ejected with the embryo's they include, before nine or ten months after they have received life, are not yet produced more perfect than thoſe, which, though impregnated at the ſame time, are laid ſeveral months after, and during all the intermediate time.

CLAR. I comprehend but obſcurely the wonder you would have me underſtand. Can't you make it more obvious to me?

EUGEN. A compariſon will ſuffice. I ſhall take it from animals, well known and familiar to you. When, in ſpring, you couple your nightingales to make them lay, if, after the firſt eggs, you ſeparate the male from the female; and, notwithſtanding this divorce, the female, ſhut up by herſelf, in a cage, ſhould continue to lay ſeveral eggs, during the courſe of the year; if that after ſhe paſſed the winter in the ſame widowhood, ſhe ſhould begin the ſpring following to give you more, and all theſe ſhould be impregnated, and ſhe ſtill a widow, you would cry a prodigy. It is this very prodigy, which ceaſes to be one amongſt the Bees.

CLAR. I comprehend you.

EUGEN.

EUGEN. Since you would have our converſation end here, ſuffer me to make a ſmall recapitulation. I have now told you, that ſwarms are compoſed of Bees of all ages, both old and young. I have ſhewn you, how one may know the age of theſe Bees: at what time the queen may be rendered fruitful: that the antients were miſtaken, in fancying the time of laying to be a time of joy, during which all labour ceas'd in the hives. You have ſeen the queen lay; you have been witneſs of the reſpects, homage and ſervices, which the other Bees pay her on that occaſion. I have inform'd you that there are other circumſtances, wherein they pay her the ſame: that the workers don't endeavour to conceal their queen, during her time of laying, as was commonly thought; the reaſons, which ſhe has to prefer ſome cells to others, to depoſite her eggs in: in fine, how many ſhe lays in a day, the greateſt part of which are not excluded, till a great while after their impregnation. The natural order will lead us to diſcourſe, on the firſt occaſion, of thoſe eggs; in what manner the Mother-bee depoſites them in the *alveoli*, and the maggots, that proceed from them.

CON-

CONVERSATION VII.

Of the eggs: the birth and nouriſhment of the maggots, and the tiſſue they ſpin.

CLARISSA.

YOU ſee, Eugenio, that I am come firſt to the hive. You may judge, by my diligence, of the inclination you have given me to underſtand the wonders, which theſe admirable Bees preſent us with. I was deſirous to try, in your abſence, if I could not diſcover ſome eggs, and give you the pleaſure of finding me ready inſtructed. But they are plung'd ſo deep in their cells, and theſe cells defended by an army of Bees ſo noiſy and briſk, that for this quarter of an hour, ſince I have been employ'd on this comb, where we yeſterday ſaw the queen lay, I have not yet been able to ſee them, but very confuſedly.

EUGEN. There requires ſome little application in our obſervations, if we are minded to ſpare ourſelves a good deal of trouble, and ſee diſtinctly what we are deſirous of ſeeing. It is not by thus obſerving at a diſtance, and through a glaſs, that you can ſee, as you ought, the Bees eggs. Here is a piece of a cake of wax, which I order'd to be cut this morning from one of the hives. I was pretty certain I ſhould find eggs

in

in it. I cut off from this comb, this cell, I pre- Plate VI.
ſent you with, or rather this half of a cell. I Fig. 3.
cut it longwiſe, that you may there ſee the egg in the ſame place and ſituation, in which the Bee depoſited it. This little white body, attach'd to Lett. A.
the bottom of the cell, like a nail, is the egg. Let us firſt examine its form.

CLAR. I fancy that will not be difficult, ſince theſe eggs appear to me like thoſe pickled cucumbers, whoſe taſte you ſo much commended.

EUGEN. This compariſon gives a juſter idea of your ſpleen than the form of the egg: It does not fix in the mind any determin'd figure, which repreſents to us the different dimenſions, which are proper to all bodies; it does not inſtruct us concerning the exterior appearances, which characterize the thing one would be acquainted with. Should you aſk a perſon what a wolf is? would you be well inform'd, if the anſwer was, it is an animal repreſenting a dog.

CLAR. Not much, truly. Teach me therefore to make a deſcription according to rule.

EUGEN. 'Tis a ſcience born with every perſon, who has judgment. It is your own fault, if you don't uſe it right. A Bee's egg is five or Plate VI.
ſix times more long than broad; its two extre- Fig. 4.
mities are rounded, but one of the two is much more ſo than the other: 'tis that, by which the egg is not faſtned: it is a little bending, which gave you the notion of a pickled cucumber: its colour is of a bluiſh white, ſomething reſembling an opal: The cod, which ſerves it for a cover-

ing, is like that of ſeveral other inſects, a flexible member; it is its ſelf ſo: one may bend it almoſt in two, and make it take again its firſt figure.

CLAR. Bend an egg! that is pleaſant.

EUGEN. Pleaſant as it is, 'tis no leſs true, and equally true, that it may be done without injuring the embrio. To the naked eye, aided by a tolerable magnifying glaſs, this egg appears extreamly ſmooth; but ſeen through a micreſcope, which magnifies very much, you will perceive ſome work, which you wou'd think on its ſurface, and which, perhaps, is in the inſide. I have ſeen ſtreight ſtrokes reſembling very long lozanges. As to the manner it is plac'd in, it is as ſingular, as its flexibility. The Bee faſtens it by the ſmaller end, to an angle at the bottom of the *alveolus*, and the moſt uſual ſituation ſhe gives it, is to be parallel to the horizon.

Plate VI. Fig. 3. Lett A.

CLAR. Parallel to the horizon! a very learned word. It is lucky that the view of the object aſſiſts me to conceive it. I conceive likewiſe this manner of placing an egg is pretty ſingular. If my poultry ſhould ſo ſtick their eggs againſt the wall, I ſhould have ſomething to laugh at.

EUGEN. If it was their cuſtom, and in conſequence of a natural inſtinct, you would not think it ſo adviſeable to laugh at it; your curioſity would only carry you to know the reaſon of it. I can only gueſs at that, which determines the Bees to act ſo. I ſhall inform you of it in its proper time. Let us purſue the fate of our eggs. I have given you to underſtand, the Mother-bee

leaves

leaves but one egg in every cell. 'Tis however a rule with exceptions; and the caſe, in which it admits it, is eaſy to be ſeen. If a mother preſs'd to lay, finds not as many empty cells, as ſhe has eggs ready to be excluded; or if the Bees have not ſufficiently advanc'd their work to afford a cell to each of theſe, ſhe has nothing elſe to do than to depoſite ſeveral in one. She ſometimes lays there two, ſometimes three, I have ſeen as many as four; but all theſe ſupernumerary eggs are abſolutely loſt: they are clapp'd there only to eaſe the mother, who could defer the time no longer. One cell can be of ſervice to bring up no more than one maggot. The time comes, in which the inſect, at its excluſion from the egg, and under the figure of an nymph, will fill the whole cell. Two eggs, and, conſequently, three or more, would be lodg'd there, but little at eaſe. The Bees, who know this, as well as they know every other thing that is neceſſary for them, and whoſe higheſt intereſt it is to preſerve the life of the maggots, go from cell to cell, to remove the ſupernumerary ones, and to leave no more than one egg in every cell. I am aſſur'd of this by my own eyes: an experiment, of which I will ſpare you the detail, convinc'd me of it. Whether the eggs thus taken away by the Bees are deſtroy'd, or whether they are placed elſewhere, in order to preſerve the embryos, I am not able to inform you. But one circumſtance, which ought not to be omitted, is the deference, which they pay to thoſe eggs, from whence queens are

to be produc'd. The Queen-bee, who is well appriz'd of what she is going to lay, never fails of placing them in those large *alveoli*, which we name *the royal cells*: there is no fear, that she will put more than one there; she considers them of more importance than to treat them as the populace. You have now seen an egg laid, and put in a place proper to give birth to a Bee. You expect, doubtless, to know how it will be hatch'd. This is likewise one of those articles, concerning which men have entertained very false ideas. The greatest part of authors, who have wrote of Bees, without having nicely examin'd them, have pretended they hatch'd their eggs, deposited in their cells, after the manner of birds. Some have bestow'd this office on the males; some have even call'd them by no other name than that of the hatching Bees. Vandergroen, in a work, which has this title, *The Low-country-Gardener*, directs, that when a swarm has left a hive, one should throw it down, and visit all the combs; and he prescribes, *with a very sharp knife, to cut off the head of every hatching Bee, and likewise the heads of those, who are not yet parted from their cells.*

Plate IX. Fig. 3. Lett. A A.

CLAR. This burlesque precept gives me no great idea of your Flemish gardener.

EUGEN. Other authors have charg'd the Working-bees with the care of hatching the eggs: But all these different opinions are erroneous.

CLAR. Is it, however, necessary they should be hatch'd?

EUGEN.

EUGEN. It is not neceſſary they ſhould. Nature knows how to come at her ends by different ways. The turtle, the oſtrich, the crocodile, and all the numerous tribe of fiſhes, don't hatch at all. The general rule amongſt inſects, is to leave their eggs to the diſpoſition of the air, and the warmth of the Sun. The Bees eggs require nothing, towards their hatching, but the warmth diſperſed through the hive. This is no moderate warmth; it approaches very near, and ſometimes exceeds that, which a hen can beſtow on her chickens, on whom ſhe conſtantly ſits.

CLAR. How was you able to collect theſe two kinds of heat in order to compare them?

EUGEN. By means of a thermometer; and I found that both one and the other exceeded, by two degrees, the heat we felt in our hotteſt ſummers, as were thoſe of 1706, and 1707. Thus both the eggs of hens and Bees undergo the ſame degree of heat; but not for the ſame time. The firſt for one and twenty days; but the Bees not above three or four at moſt. In two or three days, a Bee's egg is laid and hatch'd: and as they are laid ſucceſſively, they are hatch'd ſo too during all the months of the year, excepting winter. I can't give you a ſight how the eggs are hatch'd, nor how the young one comes out of it; there are ſome moments, which one has not in one's own power. You will, at preſent ſatisfy yourſelf with hearing an account of it, which will not, however, make ſo ſtrong an impreſſion, as if the object was preſent.

CLAR. Inſtead of an object to aid my imagination, I will repreſent to myſelf, during your diſcourſe, my little chickens quitting their eggs, and from thence will draw a compariſon, with your Bees leaving their eggs.

EUGEN. Take heed, Clariſſa, and do not compare things ſo diſſimilar together. Nature does not here leſs obſerve the ſame laws, than ſhe does in the production of large animals. It is an article, which well deſerves to be explain'd to you at large, becauſe it will diſpoſe you to comprehend an important metamorphoſis, which the Bees undergo, preſently after their birth. Large animals are born, either from an egg inclos'd in the belly of their dam, if we give our aſſent to the opinions of great numbers of anatomiſts, or from an egg hatch'd out of their bellies, which cauſes the firſt to be call'd *viviparous*, the others *oviparous*. Both in the one caſe and in the other, they proceed from the perfect egg. Nature ſeems to have made made greater preparations for them, than for us. She has made them paſs (at leaſt the greateſt number of winged inſects we are acquainted with) through ſeveral ſtates, before ſhe brings them to perfection: She cauſes them to be three ſpecies of animals ſucceſſively, which, by their exterior figure, ſeem to have no relation one to the other. Let us examine a butterfly. It is at firſt contain'd in an egg; but how does it get out of it? It is not a butterfly; 'tis a worm, which outwardly reſembles it in nothing; a worm, which we call a caterpillar, which crawls,

brouſes the herbage, has ſtrong grinders, a prodigious ſtomach, a great number of legs, which ſpins, and make itſelf a cod, with great art. After certain days, prefix'd by nature, this worm changes figure and becomes what we call faba, or chryſalis, and nymph, in other inſects. The animal does not take this form, 'till it has put off its ſkin, its legs, the exterior covering of its head, its cranium, its grinders, its ſpinning-bag, and its prodigious ſtomach, with part of its lungs. In this ſtate it covers itſelf with a hard and ſtrong membrane, which encloſes it round, without affording it the liberty of any of its limbs: thus pack'd and bundled up, it paſſes a very remarkable time, ſome more, others leſs, ſome more than a year, without taking any food and in a total inaction. During this lethargy, is made an inſenſible tranſpiration of the ſuperfluous humours, which occaſions a ſolidity to the interior parts of the chryſalis; and, at laſt, from this body, between a living and dead animal, an animal comes forth, who retains nothing more of its firſt figure. The firſt crawl'd; this flies; the firſt brous'd the herbage, and trail'd itſelf clumſily on the ground; this inhabits only the region of the air, lives on honey, on dew, and juice, extravaſated from flowers. When a worm, it had grinders to break its food; now a butterfly, it has only a trunk to ſuck. The worm was perfectly ignorant of the pleaſures of love; it had no knowledge of its ſex. The butterfly ſeems to have no other reliſh, and to be only born to pro-

pagate its ſpecies. The old philoſophers reaſon'd very much on theſe changes, and often very ill. Some of them took theſe changes for compleat metamorphoſes, others conſidered the ſtate of the *faba*, or *chryſalis*, as a real death, and the return of the animal into a butterfly, as a perfect reſurrection. There is nothing more oppoſite to truth, and even to reaſon, than theſe contrary opinions. The ſilk-worm, take it when you will, be it worm, or *chryſalis*, or butterfly, never ceaſed to live, or to be the ſame animal: the only difference to be remarked in theſe different ſtates is, that it had, when a worm, parts, which muſt be unuſeful to it, when a butterfly; they are dryed up and deſtroyed, when the worm has taken the form of a *chryſalis:* the other parts are neceſſary to the butterfly, as wings, and a trunk; the parts of generation being of no uſe to it when a worm, began not to expand themſelves, but when the time of uſing them drew near.

CLAR. Thoſe parts, which are deſtroyed in the middle age of the inſect, the others, which ſucceed them, for the uſes of a new kind of life, appear to me very ſingular.

EUGEN. What aſtoniſhes you in theſe kind of animals, takes place in us, without giving you any wonder. How many parts become unuſeful to a child juſt ready for birth? The *thymus*, the *foram enovale*, parts, which, I ſuppoſe, you are not well acquainted with, the umbilical ſtring, which you are a better judge of, and ſeveral

more, are effaced and diſappear after birth: other parts, unknown to our early infancy, unfold themſelves in time. This change, to call it ſo, of the parts, is made in great number, and in a ſhorter time in inſects, which renders it more remarkable. This likewiſe has given a handle to ſome authors, to conſider the caterpillar or ſilk-worm, as an animal different from the butterfly, and to fancy, that the butterfly is a fœtus nouriſhed and brought up in the body of the worm: it is however eaſy to ſhew the contrary. A fœtus may be loſt in the belly of its mother, without her receiving any hurt. The mother ſubſiſted; nothing was wanting to make her a compleat animal before the formation of the fœtus; and the fœtus, after its birth, leaves the mother as perfect as ſhe was before; becauſe the mother and the fœtus are two perfect animals, which have each one heart, lungs, a brain, and all the parts neceſſary to life. It is not the ſame with a worm and its butterfly. Let us draw our example from the ſilk-worm. If you have recourſe to anatomy, and open a ſilk-worm, while it is in its vermicular ſtate, you will ſee it has diſtinctly a heart, or a long artery, which performs its office, the ſpinal marrow, a brain, a great number of muſcles, lungs, or to ſpeak more juſtly, overtures that ſupply their place. Open a ſimilar animal, when a *chryſalis*, open it when a butterfly, you will always find there the ſame brain, the ſame ſpinal marrow, the ſame muſcles, and part of the lungs. All theſe parts, eſſential to life

life and motion, are one, each ſeparately, or in a number neceſſary for an animal. There are not then two animals, for one of theſe would want a heart, a brain, muſcles, lungs, *&c.* which cannot be ſuppoſed.

CLAR. This reaſoning appears convincing. You unravel, Eugenio, myſteries, wholly unknown to me. I brought up in my youth, nay, I was already a pretty big girl, I brought up, I ſay, ſilk-worms, I fed them and made them ſpin. What I have now heard makes me bluſh at that ſtupidity, in which I ſaw them paſs from the ſtate of a worm to that of a *chryſalis*, and from that to a butterfly, without the leaſt notice of what was wonderful in theſe changes. I was only touched with thoſe pretty cods or balls, with the ſilk yellow, or white, which they ſpun for me. I was a child, which one may be at every age; I only then ſaw the ſuperficies of things. The little diſcernment I had ſuffer'd me to ſee no wonder in a ſubject, which every way offers itſelf. 'Tis a misfortune for youth, when it finds nobody to teach it to behold objects, as they ought to be ſeen. My family will be the better for your lectures.

EUGEN. You will likewiſe inform them, nor will you be a loſer by ſo doing, that the Creator has diffuſed ſo many marks of his omnipotence upon the earth; that if reaſon is given us to know him, 'tis in his works we ought to ſeek that knowledge: 'tis there we find that light, by which we diſcover him, which pervades, which

aſtoniſhes

aſtoniſhes us, by which we are convinced, and which leads us to adore him, and which makes us paſs from adoration to love. What think you now of thoſe perſons, who deſpiſe, or treat as childiſh trifles, the ſtudy of natural hiſtory, and eſpecially that of ſmall animals; who imagine, (for there are ſtill ſuch, as you once was, they are in their infancy, they judge only from ſuperficies,) who imagine, I ſay, that the leſs a body is, the leſs attention it deſerves: that it is more noble to ſtudy an elephant than a piſmire; a horſe, on which we ride, than a worm we tread on: as if Omnipotence was leſs conſpicuous in a little worm, that breaths, that moves, that eats, digeſts, and produces its likeneſs, than in a tyger or rhinoceros, which do nothing more? Theſe ſort of men, doubtleſs, meaſure the power of the Creator, by the foot, the inch, or the line.

CLAR. The moſt indulgent thing I can do for them, is to pity them. If I know myſelf, I ſhould never leave theſe reflections; and we ſhould make great advances in them. However we muſt put an end to them. I know at preſent, and pretty well too, the metamorphoſes of inſects, and to what they are reducible. Let us apply this knowledge to Bees, and trace them through their three ſtates.

EUGEN. The three ſtates of a Bee, after it has left its egg, are thoſe of a maggot, then a nymph, then a Bee.

CLAR.

CLAR. You owe me an illuſtration of the difference between a nymph and a *chryſalis*.

EUGEN. 'Tis true. When a ſubject is treated, which we are full of, one precipitately makes uſe of terms proper to that ſubject, or art, which we diſcourſe of; and that often, without perceiving, that the perſons ſpoken to are not obliged to underſtand the language, if I may ſo ſpeak, of the country they are tranſported to. It is a vivacity, or rather a fault I am ſubject to; but I take it for granted, you will remind me of it as often as it will be neceſſary.

CLAR. Depend upon me, and be aſſured I ſhall not ſuffer any term to paſs, that I don't well underſtand. You may have already took notice of this.

EUGEN. Till theſe laſt ages, the naturaliſts have often indifferently made uſe of theſe two terms, *nymphe* and *chryſalis*, to expreſs what is called in a ſilk-worm *faba*. But now the meaning of theſe words is fix'd. *Chryſalis* is ſaid of the change of the worm into a *faba*, when after it has ſpun its cod, the worm quits its ſkin, remains bent, becomes almoſt reduced to a pap, and covers itſelf with a new membrane, which grows dry and ſolid: this membrane preſerves it, as if it was in a box, it is all incruſted with it: the ſilk-worm and all the caterpillars take the figure of a *chryſalis*. We term that ſtate of inſects, in which they are ſurrounded, by a very fine, tranſparent, flexible membrane, and which permits

permits us to see the whole form of the future insect in its nympha-state. This is the manner, among other animals, of flies and Bees. But the Bee, before it is a *nymph*, is a maggot, and as such we will now consider it. Let us retake our divided comb, that we may place the object before our eyes. I have already told you, that the egg exists not but three or four days, after which there comes out a maggot, which falls to the bottom of its cell. You see its fall cannot be very considerable, and can hardly hurt it: it cannot incommode it so much as its shell would do, which by its cracks might give it pain, if it had been fixed to its side in the first moments of its existence. 'Tis this, perhaps, which determined the Mother-bee to fix this egg at a certain height. The maggot is long: see here a small drawing I have found among my papers, which will give you a just notion of its figure. When it is a little grown, it keeps itself continually rolled up like a ring, and its head touches its back. As it is fleshy and fat, the middle of this ring becomes plump and filled up by the flesh of its belly. If we had come at a time to see one of them quit its egg, you might have observ'd, as I have often done, that it keeps itself constantly at the bottom of its cell. When it has attained its full size, it resembles, at first view, those great, white worms, which one often finds in the trunks of rotten trees. This here is unprovided of its legs, they would have been useless to it, since it must pass its whole vermicular state, roll'd

Plate VI. Fig. 5.

Ib. Fig. 3.

Fig. 10. Plate VI.

Fig. 6.

roll'd up, and without change of place. In proportion as it grows, it becomes white, approaching to the colour of milk; it is very weak and benumb'd, which one may know by its ſlow and feeble motions, when it is taken from it, cell. Its head reſembles a little that of a ſilk-worm; it has, like it, an upper and under lip, and at the two corners of its mouth, two hooks ſcaly and moveable, which ſtop the entrance of it in uniting together. Theſe two hooks anſwer to the two teeth of the ſilk-worm. However, the maggot of the Bee is not to be fed but by a kind of pulp. For what purpoſe has nature given it ſcaly teeth? I know not. One may however gueſs, that they will be neceſſary to it, when the time of ſpinning is come; for there is a time, wherein they ſpin. Before I quit the head, I ſhould make you obſerve two little globes, which are as white as the reſt, but more ſhining; they are eyes, or rather two windows of chryſtal, which cover thoſe fifteen or ſixteen thouſand eyes, which you have ſeen in a Bee in our ſecond converſation. An important part, and that not very well known, is its ſpinning bag, placed under its mouth, that is, an inſtrument like to that, with which ſilk-worms ſpin their pretty cods or balls. Though this maggot be very well fed, and they ſuffer it not to want, it does not appear, that it daubs its *alveoli* by any excrements. All its nouriſhment turns into its proper ſubſtance; which is the cauſe, in favourable ſeaſons, that it acquires all its growth, in five or ſix days.

Plate VI. Fig. 7.

Lett. L L.

Lett. L L.

Lett. E.

CLAR

CLAR. All that you have told me is very curious; I have heard it with pleaſure: but I think myſelf obliged to interrupt you, to make you remark, that you have had little regard to my ignorance, and that you paſs too ſlightly over two articles, which would require a little more illuſtration. The firſt is that ſpinning bag, and the talent of ſpinning, which you beſtow, perhaps, out of pure generoſity, on your maggots; for I never heard, that any found either ſilk or cod in the hives; that to me is new. The ſecond is, that you have brought this poor, little animal, to the laſt term of its growth, without taking the leaſt morſel. You told me indeed that pap was given it; but may one know what ſort of pap that is, who are its nurſes, how do they give it a bill-full?

EUGEN. I am going to explain it to you. Let us begin by the nouriſhment of the maggot, and how it takes it. Laid at the bottom of its cell, according to this figure, it lies more ſoftly there than one would ſuſpect. One ſees there a pretty thick layer of a kind of jelly or pap, ſomething whitiſh: it makes, as one may ſay, the bed, on which the maggot is roll'd; or more juſtly, the back of its ſeat. This ſame matter, on which the maggot repoſes itſelf, is likewiſe that, whereby it is nouriſhed: it would be incapable to go in queſt of it: it would not be in its power to draw itſelf out of its lodge, but muſt continue there in quiet: it will be always abundantly provided

Plate VI. Fig 6.

vided there with every thing neceſſary. The Working-bees are the nurſes, which nature has provided for thoſe maggots; ſhe has beſtowed an affection for them, on which one may more ſurely depend, than, among men, one can for that of the nurſes, which mothers chuſe for their children. Several hours of the day, a Bee is ſeen to enter, head foremoſt, into the cell, where the maggot is, and there continue ſome time: what ſhe does there can't be obſerved, but we are at leaſt ſure, that it furniſhes the maggot with that matter, wherewith it ſhould be nouriſhed, and that it renews its proviſion. After this Bee is gone, ſometimes one is ſeen, or ſeveral, ſucceſſively, and at different times, that put their head into the entry of the cell, as if to ſee whether the maggot there lodged has every thing it wants: a ſingle view ſuffices them, for that often they paſs forward in an inſtant, and 'tis not ſometimes till they have examined ſeveral cells, one after another, that they enter into one, which they have known not to be ſufficiently provided. When a Bee continues ſome moments in the maggot's cell, it is, without doubt, there to diſgorge that kind of pap or jelly, againſt which the body of the maggot is ſupported, and with which it is ſurrounded. When that is done, the little one wants nothing but to turn its head, open its mouth, and ſwallow; it has no occaſion for a bill-full.

CLAR.

CLAR. I am pleaſed with the ſituation of your maggot. Our new-born children would ſpare us a good deal of trouble, if we could get rid of them in laying them upon a heap of pap, which one ſhould have a care only to keep up in proper quantity, and acquieſce, after that, in their diſcretion. 'Tis then that a body may ſay, very juſtly, that nurſes have a good time of it. Excuſe me this trivial ſaying; you are free to return me another. Let us now ſee what this pap is, with which the Bees nouriſh their young.

EUGEN. You are not aware, that one obſervation, of which you ſhould be curious, is firſt due to you. That is the manner thoſe eggs and maggots are treated with, from whence queens are expected. I have already told you, that theſe privileg'd eggs are depoſited in much the largeſt *alveoli:* that theſe are ſo many palaces, which have been raiſed to receive theſe important and valuable Bees, which are the hope of the ſtate. 'Tis not enough, that perſons of a ſuperior rank ſhould be diſtinguiſhed by the number of their ſervants, by the magnificence of their caſtles; they ought to live too in an abundance and ſuperfluity, which is leſs a ſign of their immoderate deſires, than of that ſplendor, which ſhould always attend on the ſupreme rank.

CLAR. That is what was ſaid of the wiſeſt of all kings, that he ſupported his wiſdom with magnificence.

EUGEN. You will ſay the ſame of our queen. Not only the workers are at a greater expence of wax, to build her a royal cell, than they are at in building a hundred, or a hundred and fifty common ones; they beſtow likewiſe food on her to exceſs, and far beyond what is neceſſary: a great deal of it is left, which dries in the cell, after the time of making uſe of it is over. The kitchen too furniſhes for her different ragouts. I have taſted of her pap; it was a kind of ſeaſoned ragout, a little ſugar'd, mixed with ſomething hot and acid. This ſauce, perhaps, appears odd to you; but every one has his taſte. If they beſtow, on the queen, food without meaſure, and with a ſort of profuſeneſs, it is not ſo with the other maggots; their morſels are number'd. Their nurſes proportion their pap in ſuch a manner, and with ſo much œconomy, that when the time is come, wherein they have no need to eat any more, there remains nothing. Their care for theſe young embryo's is not confined to the proportioning the quantity of their food, but likewiſe to the accommodating its quality to its age. The pap is made lighter and more delicate for the young; 'tis ſtronger and more ſubſtantial, in proportion as they grow and become more vigorous.

CLAR. You muſt certainly have paſſed your life in a hive, to know theſe things.

EUGEN. That is not neceſſary. It was ſufficient to taſte this liquor at ſeveral times. I have taken ſome of it in the cell of a young Bee, and found it wholly inſipid, and like paſte.

When

When I tasted that of the maggots, beyond the middle size, I found it not so insipid; it had a small relish of sugar or honey. The matter taken from the cells of the oldest maggots had a taste of honey very plain and sensible. In fine, in the cells of those near their term, that is, near the time when they were to leave off these sort of aliment, the jelly had a strong taste of sugar, without the insipidness of honey, but only a little tartness. The differences, which the taste furnishes, are not the only ones, which are found prepared for the nourishment of their different ages; attentive eyes can discover others. The nourishment of the young maggots more resembles pap, and is whitish: that of the more aged is more like jelly, more transparent, and its whiteness disappears: it sometimes borders upon the yellow, at other times on the green. It seems as if it were by degrees, that the Bees conduct the maggots to be in a condition to feed themselves with real honey, of which they are to make use, when in the form of Bees. As to the origin of this food, I was not able to learn it: I can't tell you whether the Bee gathers it, as she does honey and wax. Swammerdam, who had observed and studied it, leaves us nothing positive concerning it. He proposes a conjecture, which he himself soon after destroys, to hint another, which I would willingly assent to. He thinks, that the honey, and I would add the crude wax, which the Bees have lodged in their bodies, receives there a preparation, by which it becomes a

ſort of pap, which is the nouriſhment of the maggots: in digeſting this more or leſs, they give to it the ſeveral degrees of inſipidity, or the ſugar'd taſte, which we found in it. This ſuppoſes them to have a very peculiar faculty. When we have taken food into our ſtomach, we have no longer any power over it; the only remembrance left is what intemperance or gluttony may occaſion. But it ſeems the Bee feels the degrees of digeſtion, through which the food paſſes, and that ſhe has it in her power to work it up to ſuch a degree, more or leſs perfect, as ſhe ſhall judge proper, to form that pap, which we have found ſo different in its taſte.

CLAR. I ſhould never have imagined, that the taſte could have been of ſo great ſervice in philoſophy. You have taſted the venom of the Bee, the pap and jelly of the maggots. What have you taſted beſides?

EUGEN. Swammerdam carried his curioſity farther than I. Thoſe maggots, which are white, fat, and in good plight, tempted his appetite. He was determined to know, by his own experience, what taſte they had: he tells us he found it very diſagreeable, reſembling that of the pancreatic juice of fiſhes.

CLAR. Pancreatic juice! there is a word for a female ear.

EUGEN. I mean a taſte like ruſty bacon.

CLAR. That is better underſtood, but makes the food not more delicate.

EUGEN.

EUGEN. After the maggot then has liv'd five or six days, some times a little longer, according as the season is more or less favourable, she prepares for her change into a *nympha*.

CLAR. Could not you have tasted too of a *nympha*, without boasting?

EUGEN. You seem to be gay, Clarissa, and to have forgot the obligation you have to the person, who first eat a fresh oyster; you, who had thought, a little while ago, to erect a statue to him. But let us leave off pleasantry, and finish our history. I have hardly any thing more to say to you about them to day. When the Bees find, that the maggot has its full growth, they leave off bringing it food: they know it has no more need of it, and that it is time to dispose itself to one of the most laborious operations, wherein its life will be in danger. For the change of the maggot into a *chrysalis* or *nympha*, is a passage as dangerous, as child-birth among us. The Bees, who have supported the young maggot 'till now, have still a last service to pay her, in which they never fail: it is that of shutting her up in her little lodge, and to block up the entry into it exactly with wax, to the end it may not be expos'd to visits, which can't but incommode it, and that it should not have any communication with the exterior air. That being done, and having no other services to pay her, they leave her to chance; 'tis her business to look after the rest. The rest is nothing more than to hang her cell with silk. You will be no more

inclin'd than I to believe her vanity puts her upon this expence. We muſt then believe, that the bed of wax, which was proper for the maggot, is not ſo to the *nympha*. Our ſolitary foreſees, that the ſkin, which will cover her after her metamorphoſis, will be more delicate than that, which cover'd her when a maggot, and that it is not to be expos'd, when it is new and exceſſive tender, to the touch of its cell's partition. As there is now no more of that pap, which ſecur'd the maggot from this inconvenience, nature has inſtructed it to guard itſelf by another method. 'Tis in hanging its *alveolus* with a ſoft, dry, and conſiſtent matter, which hinders the wax from penetrating to her. Nature, in giving her this foreſight, has provided her at the ſame time with the way of coming at it. She has beſtow'd on her a proviſion of ſilky matter, which ſhe ſpins out of her body, and with a proper inſtrument to draw it into a thread, like that of a ſilk-worm.

Plate VI. Fig. 7. Lett. E. 'Tis that inſtrument, which we call a ſpinning-bag, and which I ſhew'd you in the firſt deſign. The ſilken thread, which our maggot ſpins, is extremely fine and cloſe: it is hung againſt all the interior ſides of the cell; it falls in with the angles; it ſerves, as one may ſay, for a lining to the whole *alveolus*; it is compos'd of ſilky threads very near, and which interſect each other. I ſhall not wait 'till you demand proof of a fact to you unknown, and which you can't be tempted to believe. There is, however, nothing ſo eaſy as to be convinc'd of it: you need only gently melt,

melt, by a fire, the wax of an *alveolus* thus ſtopp'd up, or to break it with ſome care; the wax ſeparates, and falls, and the ſilky tapiſtry, which is ſtronger than the wax, remains intire; it remains like a thin membrane, beyond which one ſees the maggot, or its *nympha*. This membrane or pellicule is compos'd of many membranes clapp'd on, one over the other; one may tell twenty of them. The reaſon of ſo great a number of linings ought to be known. When a worm has hung its cell, and is become a *nympha*, and then a Bee, and when this Bee has pierced the partition with which the others had block'd up its cell, the workers come that inſtant to clean the place, take away the filth, the old veſtments, or, in terms of art, the *exuviæ* of the maggot, and thoſe of the *nympha*; but they don't deſtroy the tapiſtry. The *alveolus* thus brought to its former cleanneſs may ſerve to bring up another maggot; the Mother-bee comes there to depoſit another egg: the ſecond maggot, which inhabits this cell, there ſpins, like the firſt. The ſame cell may therefore be hung with a new lining of ſilk, many times in a year. It is the ſame cell, which has ſerv'd for the habitation of ſeveral maggots, and which, conſequently, hath received ſeveral ſilky linings. The cell, which has had moſt of them, far from being leſs in value, is ſtronger and more ſolid than the other; it is leſs liable to be broke, than thoſe which are only compos'd of wax. The tapiſtry ſupports and ſtrengthens the walls. Some authors pretend, that theſe cells

were hung with the old ſkins left off by the Bees, in the time of their metamorphoſis: but they are miſtaken, and have laid down this aſſertion, becauſe they were ignorant, that our maggots had the art of ſpinning ſilk. What I have told you, only regards the common cells; as for thoſe, deſtin'd to receive the queens, they are treated with more diſtinction; they never ſerve but once: when the Mother-bee has left it, the others come to deſtroy it that inſtant; they leave only the foundations, on which they build hexagon cells.

CLAR. See then our little maggot well clos'd and cover'd in its apartment, and very commodious in its furniture; we may leave it there. You will inform me, the firſt opportunity, how it changes into a *nympha*.

EUGEN. This article will not keep us long: we may likewiſe ſee its paſſage from a *nympha* into a Bee, and the firſt excurſion of it when a Bee.

CON-

CONVERSATION VIII.

Change of the maggots into their nympha-ſtate, and of the nymphæ into Bees. Prolongation, at will, of the life of inſects. The firſt iſſuing of the infant Bee from the hive.

CLARISSA.

SINCE our laſt converſation, Eugenio, I have had my head ſo fill'd with the ideas of the chryſalis, eggs, maggots, and metamorphoſis, that I know not where I am. I dream of nothing but their pap and jelly. This morning too I carried the diſtraction ſo far, as to aſk of my child's nurſe, how my little *nympha* did; I call'd its cradle an *alveolus*, and its clouts *exuviæ*. I took it in my head to be diſpleas'd, becauſe the little innocent did not pay me reſpect and homage. In fine, I had ſuch a confuſion of new ideas in my brains, that ran counter to thoſe of the antients, that I had lik'd to have loſt all patience, and bid adieu to the obſervation of Bees, for the remains of my life. Yet my curioſity has led me hither again. I am determin'd, at all hazards, to go through it; and though I ſhould become a *nympha* myſelf, reſolve to know how a *nympha* becomes a Bee.

EUGEN. Without becoming either *nympha* or *chryſalis*, you ſhall know, when ever you pleaſe,

pleaſe, how to diſtinguiſh between your old and new acquaintance. Wherefore I ſhall make no difficulty to relate the laſt accident of maggots, from whence they are to become Bees. When the covering of wax is once put upon a cell, the maggot there inclos'd, of whatſoever ſort it be, whether female, worker or drone, has no farther need of any foreign aſſiſtance; it is big enough to look after itſelf. It unrolls itſelf, becomes longer, ſpins ſilk, hangs its chamber with it, and, at length, transforms itſelf into a *nympha*; that is, it quits its ſkin of a maggot, and cloaths itſelf with another much finer, for that is the reſult of this firſt Metamorphoſis. This *nympha* is, at firſt, extremely white; afterwards its eyes take a tincture of red, which becomes more and more viſible; greyiſh hairs appear upon its body, and on its corcelet. When all the parts of the *nympha* have acquir'd, by an inſenſible tranſpiration, the conſiſtence proper for a Bee, then it is in a condition to appear abroad. It begins by putting off its fine covering, that kind of white and tranſparent veil, which held all its exterior parts bound up, and which conſtituted it a *nympha*. Afterwards it makes uſe of its teeth, to pierce and throw down this waxen partition, with which the Bees had enclos'd the entry of its cell. You have ſeen, that the maggot pierces its egg two or three days after it was laid; that it takes food for five or ſix; but the *nympha* continues fifteen or thereabout enclos'd. Thus we compute one and twenty days in favourable

Plate V. Fig 5.

ſeaſons,

ſeaſons, betwixt the laying of the mother and the birth of the Bee. In cold weather the proceſs is longer, and ſhorter in warm.

CLAR. Have you a good reaſon to give me up on this difference of growth, which you make depend, more or leſs, upon heat? All the animals I am acquainted with have a fix'd time, which does not depend on the variety of ſeaſons, for the carrying of their young, or hatching their eggs: it is invariably the ſame, be it winter or ſummer.

EUGEN. I could give you, inſtead of reaſons, many examples of animals, whoſe growth is more accelerated in warm weather than in cold. I could even carry you much farther, in letting you ſee from inconteſtable experiments, that we can prolong or ſhorten, at will, the life of inſects, without any other myſtery, than diſtributing to them the ſeaſons at our own pleaſure. But this would be a deviation, which would lead us too far from our ſubject.

CLAR. How! prolong the life of animals at pleaſure?

EUGEN. Yes. An inſect, for example, who, according to the courſe of nature, could not live but ſix weeks, or two months, I can make live three or four years, it may be more; I know not how long.

CLAR. Ho, you excite my curioſity too much. This is no deviation; I am deſirous of immediately knowing this ſecret.

EUGEN.

EUGEN. I muſt ſatisfy you then. To make the thing more plain, I will again have recourſe to a ſilk-worm, which is ſo well known to you, as well as its progreſs. That will ſerve as an example for all other inſects. The egg of a ſilk-worm is ſeldom hatch'd, till mulberry leaves begin to appear; but you have ſometimes happened to have tardy eggs, which have been preceded by theſe leaves: you had nothing to do then, but to clap them into your boſom, and the warmth of your body haſteneth the birth of the worms. From its birth to its change into a *faba* or *chryſalis*, is about three weeks. During that time, the animal takes nouriſhment, and receives all its growth. The whole progreſs of this growth may be check'd, by keeping the animal in cold air, and accelerated by putting it into warm; but that will make no great alteration. So that is not this the period, wherein we have it in our power to prolong its days beyond the intention of nature; to make it live five or ſix times, it may be, a hundred more than it naturally would? The worm, while it continues ſo, is under a neceſſity to augment its ſize, by the addition of foreign matter, or food; to give to its parts more ſtrength and conſiſtence, that they may arrive at that ſtate, which we call *chryſalis*, which is ſtationary between an encreaſe and decreaſe. 'Tis there we can ſeize its life, fix or abridge it without doing it any injury.

CLAR. Without doing it any injury! I can eaſily conceive you do it no injury in prolonging

ing its life; but it seems difficult to comprehend that you do none in shortning it. As for myself, I should think a good deal was done to me, should any one have it in his thought to abridge my life of a single day; and I assure you I would cry out murder against any one, who should attempt it.

EUGEN. I see clearly, Clarissa, that I must give you a more distinct idea of life than you have at present. What is life? It is, according to the design of nature, a continual revolution of thoughts and actions, of degrees of growth and a decrease; for which there must be a certain time. However rapid, however sudden our sentiments and thoughts appear, both the one and the other may be much accelerated. What would there be wanting to any person in the same duration, or, to speak more justly, in the same value of life, who, by some miracle, could have, in few months, the same increase or decrease of body, and the same train of thoughts and sentiments, which he would not naturally have had but in the course of a common life? Assuredly with regard to the body and thoughts, nothing would be wanting to him; his life, though of the shortest, would be as compleat, as if it had obtained its natural course. A father, who could conduct, and that in few weeks, his children from their birth to compleat age, would he be an unnatural father? especially if in these few weeks, he had the talent of adorning their understanding with all those advantages not at-

tainable in leſs than ſeven or eight years of application.

CLAR. You embarraſs me.

EUGEN. 'Tis the ſame in an inſect, which we draw from its ſtate of a *chryſalis*, ſooner than it ſhould have quitted it: we make it run, in few weeks, through the ſame train of degrees, that it would not have paſſed over but in many months. That is done in expoſing it to a degree of heat, which haſtens its growth: juſt as when I cauſe, in my ſtove, and in the middle of winter, the *chryſalis* to diſcloſe and expand itſelf, which otherwiſe would not have been till the month of June or July following. Thus much for the life of inſects when abridged; let us proceed to their extended life. The worm never changes into a *chryſalis*, but when it has no more room to grow. The butterfly is then wholly formed; it has only need of a tranſpiration to free it from its ſuperfluous humours, of thoſe humours, in which it was, as it were, drowned, and in a drowſineſs, which, in part, intercepted the courſe of the animal ſpirits, and ſuffered not the muſcles and nerves of the exterior members to have that ſtiffneſs neceſſary to motion. This tranſpiration can't be excited but by heat; when that is greater, it becomes more quick, and more ſlow, when leſs. From thence the developing of the butterfly becomes more or leſs quick. If this tranſpiration was ſtopp'd ſhort, you clearly ſee, that there would be no more expanſion, and the animal would neceſſarily remain under the figure of a *chryſalis*: It would be conſtantly ſo, till a new

heat

heat ſhould cauſe its tranſpiration. I muſt now prove this reaſoning by an experiment. You know, from the birth of the ſilk-worm, to the death of its butterfly, is about ſix weeks; it is during this time, that nature makes it run thro' all the revolutions of its life. It grows as long as it is a worm: while it is a butterfly at liberty, it is at its higheſt period; after that it can't but decreaſe. The interval between theſe two ſtates is what I have mentioned, that of a *chryſalis*. Hinder this *chryſalis* from tranſpiring, you ſtop the whole machine, as you would ſtop a watch, by fixing the balance. Since it is heat, that cauſes fermentation within the *chryſalis*, and this fermentation provokes tranſpiration, carry your *chryſalis* into a place, where it will be deprived of this heat, as, for example, into a cool cave, or an ice-houſe, there will be no longer either fermentation or tranſpiration, at leaſt in the cave it will be infinitely diminiſhed, in the ice-houſe totally ſtopt. I was led to think in this manner, by obſerving the progreſs of nature with regard to inſects. There are ſeveral inſects, and, among them, a beautiful and remarkable caterpillar, which lives upon fennel, which, if it turns into a *chryſalis* in the month of July, becomes a butterfly in thirteen days after. But if it is not in this ſtate till the end of Auguſt, it paſſes the winter, and continues ſo for nine or ten months together. It was eaſy to conclude from hence, that in order to ſtop or retard the change of a *chryſalis* into a butterfly, nothing was required but to prolong its winter. This is what I have done. It is now three years,

ſince I have kept in my vault ſome of theſe in the form of a *chryſalis*, who are yet very lively, and would not have lived but one or two months, if I had ſuffered nature to operate.

CLAR. This experiment is not only curious, but appears to me to be very intereſting. I don't doubt but you will procure to yourſelf ſome conſiderable advantage from hence, and hope you will permit me to ſhare with you. If it was only to live in a cave to enjoy immortality, I could eaſily reſolve on doing ſo, and know a pretty many honeſt people, who would think this a very eaſy condition.

EUGEN. I was afraid, Clariſſa, that your imagination would readily ſeize this flattering idea of immortality; but I deſire you to give up this hope: a privilege like this is not made for us. A hundred good reaſons, as well moral as natural, might be produced; I ſhall confine myſelf to one of the laſt ſort. One of the principles in all animals is blood. Our blood, like that of all large animals, is of a nature very different from that of inſects, if we would chuſe to give the ſame name to theirs. Our blood thickens, and coagulates; immediately after it has ceaſed to circulate, and is once coagulated, we are perfectly dead, becauſe no heat is capable of liquifying it, and reſtoring to it its primary quality; without reckoning, with regard to us, that there is no more return for the ſoul, when once ſeparated from the body. The blood of inſects, on the contrary, would become dry, would diſſipate and evaporate

evaporate, ſooner than coagulate. When it is well encloſed, and out of the power of all evaporation, it continues itſelf a long while, during which it preſerves itſelf in a ſtate of fluidity, and ready to flow anew, when the air and heat ſhall ſet the machine in motion.

CLAR. 'Tis a great pity, that blood ſo happily conſtituted ſhould be given to inſects, preferably to reaſonable animals.

EUGEN. Whether it be a real advantage to them, and whether they be in a condition to profit, by theſe two, three or four years, and perhaps many more we could give them, is the thing to be known. Firſt of all, take notice, it is not while the animal is a worm, nor when it is a perfect butterfly, that is to ſay, while it has the enjoyment of life, that we can confer that good office: it only is, when it becomes *chryſalis* or *nympha*. Now the ſtate of *chryſalis* or *nympha* is a lethargy, during which, life muſt be perfectly indifferent to the inſect, becauſe it neither performs, or can perform any animal functions. This lethargy can be compared to nothing better than our ſleep. What uſe would it be to us, to live two, three or four hundred years in a profound ſleep?

CLAR. I ſhould not fail to find charms even here. The whole world is eager to ſee the accompliſhment of their wiſhes, and I more than any body. If I could, for inſtance, this day ſleep only for a hundred years together, I ſhould, at my waking, have the pleaſure to find grand

children, a pretty and numerous poſterity, honourable alliances, good employments in my family, perhaps ſome one of my grandſons marſhal of France, or governor of a province. It is ſaid, that Alexander wiſhed to wake after his death: had he not his reaſons? What ſatisfaction would he now have, in hearing the aſtoniſhing report of his renown? To ſee, that when one is inclin'd to carry the praiſe of a conqueror to exaggeration, nothing better can be found than to draw the compariſon from him. How many things are there in arts and ſciences, that we are now ignorant of, and which will be better known a hundred years hence, if your academy continues its improvements, as it has done ſince its eſtabliſhment? How many new lights ſhall we have, it may be on the ſubject of Bees, which you are yet ignorant of, and which you would give a good deal to purchaſe?

EUGEN. Let us ſee the reverſe of the medal. The perſon, who ſhould this day, go to ſleep for an age, leaving a numerous poſterity, noble, rich, virtuous, raiſed to the higheſt employments, might, at his waking, find an indigent family, children who died in miſery, ſome diſhonoured or dragging on a ſhameful nobility in vice and indolence. It might be almoſt wiſhed, that Alexander could riſe again, to receive the reward of his ambitious folly, in hearing, that at this time, *for good reaſons*, all people of ſenſe would *give him an apartment in Bedlam*. Should Deſcartes return, could he, without being piqued,

ſee,

ſee, what terrible blows has been given to his favourite vortices, his three conteſted elements, and abundance of other phyſical and metaphyſical ideas, which coſt him ſo many wakeful nights and ſo much application? And as for us, let us not flatter ourſelves, that our ſucceſſors will not find ſome great fault in our philoſophy. How many ſyſtems, which, at this day make the glory of their inventors, will cauſe pity, in three or four hundred years hence, to our deſcendants? I would, for a moment, give into this agreeable chimerical idea, which, at firſt, ſoothed your imagination. I ſuppoſe, that the lengthening life, by long ſleeps, was found out, and that the offer was propoſed to you: you would make, before you accepted, ſome reflections, you have not yet made. Would you dare to plunge yourſelf into a ſleep, for a courſe of years, during which, you would be expoſed to periſh by a thouſand accidents, againſt which you could not be in a condition to defend yourſelf; by fires, inundations, murders, the conſequences of war, the greedineſs of your heirs, the negligence of thoſe, who ought to watch for your ſecurity? I ſtill go farther. Suppoſe you are lucky enough to avoid all theſe misfortunes, and to wake ſafe and ſound, at the end of an age; what would you find in the world? A new world, not one jot better than the old; people, unknown to you, and who would not give themſelves much trouble to gain your acquaintance: your eſtate divided among your heirs, who won't be in a humour to

part with it. You were rich at your going to ſleep, but will wake poor.

CLAR. You make me tremble; I had much rather die. Let us therefore amuſe ourſelves no longer with this dangerous chimera. You would therefore do well not to ſpeak to me of thoſe experiments, which only leave a ſad regret to ſee my hopes vaniſh as ſoon as formed.

EUGEN. Experiments of pure curioſity have their charms; but when they lead to ſomething uſeful, the profit is double: that ſometimes happens, when we think the leaſt of it. Such are thoſe we have made on the life of inſects.

CLAR. I can't ſee the advantage, which a *chryſalis*, carefully preſerved, three or four years, in an ice-houſe, or a vault, can give us. Is it a remedy againſt ſome diſtemper?

EUGEN. This experiment will inform us how to eat eggs freſh all the winter, and in thoſe times when your own hens and thoſe of your neighbours have done laying. That is ſome ſmall advantage towards good houſewifery in the country.

CLAR. Surely no; but it is a paradox, at which I ſhould ſmile, if any other but yourſelf had propoſed it. What affinity is there between a *chryſalis* and a freſh egg?

EUGEN. I don't propoſe, that you ſhould compare them together; my deſign is only to tell you, that the art of preſerving a *chryſalis* has led me to preſerve eggs for years, and always as freſh as they were that day they were laid. To

draw

draw you from that embaraſſment, into which my propoſition has thrown you, pleaſe to remember, that the *chryſalis* is not preſerved for ſeveral years, but by ſtopping its tranſpiration. A hen's egg, like that of another bird, is almoſt a *chryſalis*. By ſtopping its tranſpiration, you will preſerve it, as one would a *chryſalis*. To prove it, let us obſerve what paſſes in an egg, in proportion as it corrupts in air, or receives its fermentation under a hen. Notwithſtanding the compact texture of its ſhelly covering, the egg tranſpires daily; and the more it tranſpires the ſooner it is ſpoilt. Every body knows, that in a freſh egg, dreſſed or not, the ſubſtance of the egg very ſenſibly fills its ſhell, and, on the contrary, there remains a void in an old one, by ſo much the more ſenſible as the egg is ſtaler. This vacancy is the meaſure of that quantity of liquids, which tranſpired through the ſhell. When you hold it between your eye and the light, if you perceive it has a vacancy in the upper part, you ſay it is not freſh, and you ſay right. The modern philoſophers have found the method of diſcovering the canals, thro' which an egg tranſpires: they have ſeen thoſe air ducts, which have a communication through the egg to the exterior air. The peaſants of ſome of the provinces of the kingdom act as if they underſtood this part of natural philoſophy. They preſerve thoſe eggs, which their hens laid in autumn, to ſend them to Paris in winter. They keep them in tubs, ſurrounded on all ſides with aſhes, cloſe preſſed. They keep them alſo in water, which

has nearly the same effect; but neither the water or the ashes absolutely stop all transpiration; they only make it more slow. The egg continually finds more or less of the dissipation made in its liquor. Whoever then could communicate the secret to stop it entirely, would, at the same time, give you that of preserving your eggs through years, and perhaps through ages.

CLAR. I would settle on the person, who could furnish me with that secret, a perpetual rent of two fresh eggs every morning.

EUGEN. My fortune is made. Take pots, fill them with new laid eggs, and pour over them mutton fat melted. Only take care, that this fat be not too warm to scald the eggs; it will run into all the hollows, that are between, will surround them perfectly on all sides, and guard them from all communication with the outward air. By so simple a method you may preserve them for years. I have actually some by me, which I have kept for two years. A fortnight ago I ate two, which had no fault to be found with them.

CLAR. I will this very day give orders, that your rent shall be exactly paid, and to-morrow I will make a present of this secret to all my neighbours. It is time to return to our Bee, which we have left in its little prison. Tell me how she extricates herself from it.

EUGEN. As soon as the *nympha* had got rid of her skin, she commences a perfect Bee. Her first care is to perforate the wall, with which they have cloistered her up. At first she makes

uſe of one of her teeth, to make a hole about the middle. This being made, ſhe employs her two teeth to dig down the wax, and make it humble; the opening by degrees makes it more large: at length, in about three hours, when the recent Bee is vigorous, and the ſeaſon favourable, it makes the opening large enough to admit its coming out. The Bees leſs ſtrong, and in days not very warm, are ſometimes half a day in doing this. This work is likewiſe above the ſtrength of ſome, who die in their cell, after having made an opening, through which only their head or part of it is able to paſs.

CLAR. Ha! What becomes then of that tender love, thoſe officious cares, that charitable vigilance of the Bees towards their young?

EUGEN. That is what I cannot tell you. I own it would coſt them little to help theſe poor little creatures, in a work very laborious for their weak condition. It was natural to imagine, that the Working-bee would open that priſon, which they had made. Swammerdam believed, as you was diſpoſed to imagine; however Swammerdam was miſtaken. The young Bee has no ſuccour to expect from his companions; his deſtiny at that time wholly depends on its own ſtrength: 'tis an inevitable misfortune, if that ſhould fail in time of need: but at length when the Bee has made a ſufficient opening, it puts through its head, then its two firſt legs, which it fixes on the edges of the hole, and by the means of which it draws itſelf forward. Soon after its other legs

are ready to come out in their turn, and then it is not long before it diſengages its whole body. This labour over, it appears a perfect Bee in full ſight; it ſupports itſelf on its ſix legs, pretty near the cell it has quitted. Its wings unfold themſelves and grow ſtrong: its body and all the exterior parts are yet wet; but although the warm air of the hive, would not be ſufficient to dry them ſoon, they would not long continue wet. The Bees, which perceive this recent companion, approach near; they ſeem to take notice of her, by their good offices, and the joy they expreſs to ſee her. Two or three place themſelves round the new comer; they lick and clean her on all ſides, with their trunks; ſome among them even preſent it with honey.

CLAR. Here is a good deal of oddneſs. How! a Bee, to whom, but juſt now, they would not vouchſafe to lend the leaſt help, but let it miſerably periſh at its door, becauſe it had not ſtrength to open it; this Bee happily extricates itſelf from its danger: ſee it, in a moment, ſaluted, careſſed, and loaded with preſents? This forgetfulneſs and this ſucceſſive return of brotherly friendſhip has a good deal the air of one of nature's ſports.

EUGEN. Let us not uſe this expreſſion, the ſport of nature, which has no ſignification; for nature neither ſports or trifles; ſhe inviolably purſues the laws impoſed on her by her Creator. But let us agree to place this among the number of thoſe things, which we are condemned to be

ignorant of. I have told you, that young Bees may eaſily be diſtinguiſhed by their colour; that of the old one is more red, that of the young one greyiſh. The rings of theſe laſt are browner, which become more diſtinct as the animal grows old; the hairs of the young are white, thoſe of the old ones red: the Bee juſt produced has a great belly; if it is open'd, 'tis found full of the laſt honey ſhe ate while a maggot. All the parts of a young Bee are ſcarcely ſufficiently dried; the wings are hardly proper for motion, till it becomes a perfect Bee, and knows all it has to do for the reſt of its life. Don't be aſtoniſhed, that ſhe is ſo well inſtructed, and ſo early: its inſtruction is derived from him, who made it.

CLAR. How happy ſhould we be, if he, who formed our children, had given them to us perfectly inſtructed!

EUGEN. Take care, Clariſſa, not to complain unjuſtly: he would have given you nothing but machines, inſtead of docile children, as yours are: he would have deprived you of the moſt ſenſible and the moſt ſoothing of all pleaſures, that a mother can have, that of conducting them yourſelf to virtue by your counſels and your examples.

CLAR. I did not ſeek for a compliment, but you will furniſh me with more than one occaſion not to be behind hand with you.

EUGEN. Our new-born Bee then perceives itſelf made for ſociety; that ſhe ought to labour to acquit herſelf of thoſe cares they have taken for

for her; she walks some time upon the combs, by way of trial, then she disposes herself to take the open air. Other Bees, which are continually coming out of the hive, shew her where the door is; she never wants guides to direct her the way. Is she abroad? behold her upon flowers; from them she knows how to extract wax and honey. We have already seen her companions offer her this nectar before her first going abroad; if then she goes to gather some, soon after, at the bottom of flowers, 'tis less to nourish itself with than to begin to work, for the common good; to collect it, in order to convey it to those places destin'd to receive it. What fairly proves, that it is not for her own interest, that she takes the field, is, that she sometimes gathers only crude wax. M. Maraldi assures us, that he has seen Bees loaded with two large balls of wax, returning to the hive, the same day they became Bees: it is thus, that a Bee is formed, and 'tis thus they all are. The queens must always be excepted. Among Bees, as among us, kings and queens are not formed of more precious material than the bulk of the people; they are all equal as they come from his hands, who makes them; but whence once they come among creatures like themselves, things admit a change. The royal majesty is, among Bees, of divine institution, as it is among men. That respect and distinction due to them is a consequence of it. I have already prepared you, on a great number of these distinctions, but have not yet told you, that they

carry

carry it ſo far as to give to the royal maggot, in its *alveolus*, a quite different poſition from the others; and that when a *nympha*, it keeps this poſition, of which I ſhall ſpeak more largely, when we come to the royal *alveoli*. When this Bee is become a queen, ſhe goes not, like others, into the fields: her perſon is too choice to be expoſed to the dangers, which may overtake her out of the hive. She may take her walks through all the ſtreets of her kingdom; ſhe is certain of finding every where magazines filled with food, or Bees that will preſent her with ſome. In waiting till I can ſhew you in the original, Bees, for the firſt time, leaving their cells, you will ſatisfy yourſelf with this drawing, which will give you a pretty juſt notion of it. The cells marked BB, are thoſe the Bees have already quitted. Thoſe marked CC have their covering ſtill on; the nymphs are yet incloſed within them. That marked M gives you the view of a common Bee, which has put off its ſkin of a nymph, which has gnawed thro' the covering of its cell, and is preparing to leave it. R, S, is a royal cell, from whence part of the wax has been taken, or, if you pleaſe, in which has been made a window, to diſcover the *nympha* of a Mother-bee, ſuch as it appears in its *alveolus*. You ſee how much it differs from others, in ſituation and lodging. Plate VI. Fig. 8.

CLAR. Without doubt the drones too have honourable privileges.

EUGEN.

EUGEN. They have not been forgotten in the diſtribution of honours; they hold the place of grandees in the ſtate, but of thoſe grandees of ſhew, whoſe lot is very much bounded. Beſides the privilege of leading a ſoft and effeminate life, and not working for the publick, a poor privilege, and which will never paſs for a title of honour, they are diſtinguiſhed by greater *alveoli*, than thoſe of the Working-bees. This is another drawing of part of a comb, which was intended for the drones. The cells marked O, are open and empty; all the reſt are cloſed, which yet contain the maggots or *nymphas* of the drones; you ſee their coverings are not flat, as are thoſe of the other *alveoli*, but convex and ſwelling outwardly. I know no other diſtinctions they have. You now are pretty well informed, Clariſſa, of the birth of Bees. Conſider, before we paſs to other ſubjects, if you have any doubts, if I have not forgot ſomething you would willingly know.

Plate VI. Fig. 9.

Ibid. Lett. P P.

CLAR. 'Tis your buſineſs to ſee, Eugenio, that you have fulfilled your promiſe. If I remember right, you told me, a hive was a circle of living and dead Bees; and that to come at a fixed point, you divided them from a ſwarm. It appears to me, that in order to finiſh this revolution of a circle, you ſhould carry me to a ſwarm.

EUGEN. The obſervation is very judicious. To anſwer it, call to mind what we ſaid, in order to connect with what I ſhall now ſay. This Bee, which we have ſeen lay her eggs, in our

ſixth

ſixth converſation, was newly come to a hive, together with her ſwarm. You have ſeen her depoſite her eggs in the *alveoli*. I have told you how from theſe eggs maggots are produced; that theſe again take the form of *nymphas*, and theſe likewiſe that of Bees. I told you when a Mother-bee was arrived at the height of her laying, ſhe emits two hundred eggs a day: theſe eggs are to be hatched in nearly the ſame proportion: the hive therefore is daily growing more populous, and in few weeks the number of inhabitants becomes ſo great, that it cannot contain them; they muſt be divided. This is what gives occaſion to ſwarms. Theſe ſwarms might be the ſubject of our next converſation. Yet I think it will be more conformable to the order I have laid down, to diſcourſe firſt of all, of the actions of Bees, of their manner of living in their hives, and their works; in a word, of every thing, that paſſes between the arrival of one ſwarm and the departure of another. As a ſwarm is liable to have many queens, and as they begin no kind of work in a new hive, till the number of queens is reduced to one; I will firſt ſpeak of the maſſacre of their ſupernumerary queens; and, not to return, ſeveral times, to ſo mournful a ſubject, I ſhall join to it that of the males and maggots.

CONVERSATION IX.

Of the maſſacre of the ſupernumerary queens, with that of the males and maggots.

EUGENIO.

IF you do not bring along with you, Clariſſa, a heart of braſs, you are greatly to be pitied.

CLAR. Can you think, Eugenio, that one has hearts to change, as often as there may be occaſion.

EUGEN. At leaſt one ought to have ſomething to fortify ourſelves againſt thoſe ſhocks, which cruel objects give a tender heart.

CLAR. I ſhall find that aſſiſtance within myſelf. Tragical and melancholy as theſe adventures may be, which you have to relate, I am ready to hear them, and prepared for every event.

EUGEN. That is very *a propos* for you. I am going to begin with what paſſes in a hive, on the account of a plurality of queens. You already know when a Queen-bee has begun to lay, ſhe ſometimes produces ſeven, eight, and even twenty females. I, one day, found forty, at leaſt forty royal cells. It is not difficult to comprehend the reaſon of this plurality. If there was only one queen born in each hive, that would not be a ſufficient proviſion for the multiplication

tiplication of Bees. The ſwarms would often want a conductreſs. A thouſand accidents may deſtroy the little maggot, from which a queen is expected, before it arrives at its metamorphoſis into a Bee. It would not therefore be ſufficient, that the mother ſhould lay but one of theſe female eggs each year; it is neceſſary ſhe ſhould lay a ſufficient number of them, to guard againſt accidents. There are therefore many of them born; and from hence it comes, that when a ſwarm is ready to depart, many of theſe female Bees, which obſerve they are too numerous, join the colony, and follow it. The others, leſs diligent, or more attach'd to the place of their birth, continue there; it may be too, the pleaſures of love detain them there.

CLAR. The antients were undoubtedly ignorant of this multiplication of kings or queens, ſince I never heard of above one king of the Bees.

EUGEN. All the antients, to begin with Ariſtotle, have acknowledg'd ſeveral kings. They affirm, that it ſome times happens, that a ſwarm has two kings or two queens. They inform us of what is done in ſuch a caſe, which is not an uncommon one. But, according to their cuſtom, they have not been able to contain themſelves within the bounds of ſimple truth, but have added to it a mixture of the falſe marvellous. They well knew, that it was neceſſary, that one of theſe two kings ſhould reſign the kingdom to the other; but they have ſpoken of the preſerv'd king as a king

king poſſeſs'd of all the qualities which render him worthy of that advantage, and as endowed with an outward appearance proper to procure him reſpect; but they treat the rejected king as a wretched fly, unworthy of the ſovereign power, which he was ambitious of uſurping. They have been very laviſh in beſtowing on him the names of uſurper and tyrant; they have repreſented his form as hideous and at the ſame time contemptible. It is after Ariſtotle that Virgil has deſcribed both the one and the other, and aſſerted, that the forms of thoſe two kings were very different, that one of them, *viz.* the good one, had reddiſh ſcales, which ſhone like plates of gold; that its figure was noble, whereas the other was diſagreeable to the ſight; that it ſeem'd all over duſty, with a large belly; in ſhort, that it deſerved nothing but death.

CLAR. A poet, like Virgil, may be permitted to amuſe us with his agreeable ſtories; no body can be deceiv'd by them: 'tis what is expected; poetry draws its ornaments from fiction; but that a grave philoſopher, as your Ariſtotle was, ſhould give us fables for realities, is the thing, that ſhocks me. Of whom then can we learn truth, if theſe ſages join with the poets, to impoſe upon us?

EUGEN. The time of fables is over. If we ſpeak of them, 'tis only that thoſe, who are ignorant, ſhould not confound them with true facts. It is with this view, that I ſhall tell you, one cannot read without aſtoniſhment the extream

tream with confidence, which Alexander de Montfort ſpeaks in his book, call'd, *The ſpring-time of the Bees*, of this rejected Bee, aſſuring us, that what he is going to ſay, is the product of ſeveral years obſervation. You ſhall judge of the worth of his obſervations by the advantage, that will reſult from them. Montfort calls this unhappy Bee, *the tyrant or quarrelſome prince.* He ſays, *his duſky colour, his large belly, his ſwolen legs, and languid geſtures, are ſigns of envy, ambition, gluttony, cowardice, lazineſs.——That this quarrelſome prince has a hoarſe accent, which ecchoes in every quarter, careſſing the new ſouldery, whom he endeavours to inebriate, and draw into revolt againſt their ſovereign. The quarrelſome prince leaves the hive with a ſwarm, departs from his king like a traytor, or piece of counterfeit money, that dares not ſhew itſelf. As ſoon as the ſun ſhines upon his head, his bad qualities appear, and cauſe one part of his people to revolt.*

CLAR. This jargon of Alexander de Montfort, as well as his quarrelſome prince, appears to me a mere fiction.

EUGEN. It is ſo in reality. Charles Butler, in his *Female Monarchy*, comes nearer the truth; he will have it, that when the new queen has taken poſſeſſion of her *capitol*, and the empire has been granted her, the ſecond in rank is condemned to death, by a decree of the people, and immediately this decree is executed. He does not tell us, that he ſaw this execution; but he mentions terrible battles, which laſted in the hive

for two days together, where two ſtrong ſwarms had enter'd, which did not end 'till one of the two mothers was kill'd. But to ſubſtitute more ſimple and truer facts, in the ſtead of thoſe, which are loaded with circumſtances more imaginary than certain; I ſhall tell you a truth, that a ſwarm, when it leaves a hive, has often two queens, and ſometimes three; and there often remain behind ſeveral ſupernumerary Bees in the hive. I am capable of giving you an exact account of what becomes both of the one and the other. What I have to ſay, is from ocular demonſtration: when a ſwarm goes from the hive it was born in, they are often ſeen to divide themſelves into two bands, which ſettle upon the branches of ſome neighbouring tree. This diviſion is a ſure ſign, that there are, at leaſt, two queens; but then it often happens, that there are more in one cluſter than the other. One will not be, ſometimes, bigger than one's fiſt, while the other ſhall be as large as the head. Whatever the cauſe may be, that the queen of the ſmaller cluſter has drawn no more Bees after her, her company in general are not faithful to her. The Bees love to live in numerous ſocieties: the queens themſelves are not pleas'd, when they have but few at their ſervice; they ſeem to know the inconveniencies, that reſult from it. A ſmall cluſter is not then of long continuance; the Bees detach themſelves from it by little and little; and when the troop is reduced to a ſmall number, they, together with their

their queen, go to unite themſelves with the other. Then the ſwarm has two mothers.

CLAR. I clearly ſee, that we are near upon the moment of the cataſtrophe. I remember there ought to be no more than one queen in each hive, and that the other muſt be ſacrificed to the public repoſe, and to that law, which requires there ſhould be but one monarch in one monarchy. I fortify myſelf beforehand againſt thoſe horrors you are going to relate.

EUGEN. I would willingly ſpare you the recital of them. But the faithfulneſs of hiſtory requires, that we ſhould ſpeak both of the good and the evil. When theſe 10, 20, 30, or 40 eggs, which the Queen-bee has laid, are become female Bees, there are born, at the ſame time, hundreds of males, and thouſands of workers. The whole hive becomes prodigiouſly peopled. If all equally purſued the ſame end, and labour'd only for the public good, every thing would go on perfectly well. But the lazy, that is to ſay, the drones, and the ſupernumerary queens, thinking on nothing but amours, and living without any advantage to the ſociety, the magazines of honey would be quickly exhauſted. To nouriſh ſo many uſeleſs mouths, the workers would not be too numerous, with all their ſtrength; and their only employment would be to ſeek food in the fields, and continually to re-victual the place. During which time the *alveoli*, and other public works would be neglected. Beſides, the reigning queen has not yet done laying; ſhe has need

of other cells to depoſite new eggs in. A ſwarm, which carries with it two or three queens, does not wholly diſincumber the hive of all its ſupernumeraries, becauſe we know there often are 30 or 40, which will be ſo many mothers, and which will ſoon take up all the *alveoli*. Death alone can be the ſafety of the hive.

CLAR. Would it not be more worthy of a wiſe government civilly to deſire them to retire, or even to drive them out, if they are obſtinate, than to lay violent hands on perſons ſo auguſt as queens; as I am afraid will appear in a moment?

EUGEN. I will ſuppoſe they ſhould enter into your compaſſionate ſentiments: where would the poor unhappy creatures go? Into ſome corner, there to languiſh in miſery, and then die two or three ſteps from it? for every queen, that carries not a ſwarm with her, has no retreat. She immediately becomes a prey to uneaſineſs, chagrin, or birds, and above all to cold. The workers know, that it is moſt expedient for theſe poor unfortunate, to put an end, as ſoon as poſſible, to a life, which can only end in a tragical death. They kill them out of pity.

CLAR. It is great pity they were born!

EUGEN. As for them, in particular, it would have certain been better they had never ſeen the light; but the general œconomy of the univerſe requires it ſhould be ſo. It would not be difficult to prove, that many animals, to begin with ourſelves, are the prey of diſtempers, wars, murders, cruelty, and the avarice of our

fellows; and that there are none, wholly free from theſe accidents. In ſhort, that we may return to our murder'd queens, I remember, that ſix mothers were brought me one morning found dead upon the ſtand of one hive, from which the ſwarm had parted the evening before. The lot of thoſe, who ſave themſelves by following the ſwarm, is not more happy: one only is reſerved, the reſt are ſacrificed to her ſafety. The firſt proof I had of it, was from a ſwarm, which left their hive in June. The Bees, of which it was compos'd, divided themſelves into two bands of unequal bulk, which quickly reunited. The diviſion, which was firſt made, gave me reaſon to conclude there were two mothers; but the conſequence ſhew'd me there were three. Thus the numbers, which a ſwarm divides itſelf into, are not always equal to the number of queens. I have learn'd from other obſervations, that it does not always happen, that a ſwarm, which has two mothers, divides itſelf. I was curious to follow the ſwarm I was ſpeaking of. It entred peaceably into its new hive; two days after, every thing appear'd very calm. I did not perceive, in the hive, thoſe battles, which are there ſaid to be fought, when there are ſeveral mothers. Next day, about three in the afternoon, the air ſeem'd to be fuller of Bees; and more out of the hive, and eſpecially about the door, than was cuſtomary. I open'd one of the ſhutters, to obſerve what paſſed within, and was quickly ſatisfy'd there had been ſome commotion.

The Bees had left the top of the hive, where they had kept themſelves the firſt day, and where they had already built two ſmall combs. I had room to conclude, there had paſſed ſome bloody expedition. I examin'd the ground before the hive, and there found ſome dead, among which there was a queen. All the day, in which this battle was fought, the Bees did not work at all; they likewiſe paſſed the whole night near the bottom of the hive, without regaining the top: there too I found them the morning afterwards: three hours after I found another dead mother, near the place where I ſaw the firſt. This was the laſt, that was to die: thus order and peace were reſtor'd to the hive; the Bees gain'd the upper part; they placed themſelves as they had done before, and as they ought to do, and applied themſelves to work in good earneſt. The ſwarm, I mentioned, is not the only one I have had, out of which two mothers have been kill'd. It is then inconteſtable, that there are times, in which the Bees cannot ſuffer many females, and that one only is requir'd to the Bees of one ſwarm.

CLAR. It would ſurely be worth your while, to penetrate the reaſons, that determine the Bees in the choice they make of their queen. For we have ſeen till now ſo much agreement among them, that it is not probable they take a queen at hazard, on whom the ſafety and preſervation of the ſtate depend.

EUGEN. I will not poſitively affirm it is the conſequence of their reaſoning and ſettled judgment, that they prefer certain Bees to others,

to conſtitute their ſovereign; but 'tis moſt likely, that ſhe, who is rais'd to that high rank, is the moſt worthy. I do not however, nor is it neceſſary that I ſhould, pronounce this ſeriouſly, that ſhe is endow'd with every moral virtue, which has been thought neceſſary to her. Neither do you think the mothers, which have been put to death, deſerv'd ſo tragical an end, becauſe they had that blackneſs of ſoul peculiar to uſurpers and tyrants, and all the vices, that Alexander de Montfort charges them with. What I think moſt probable is, that the queen, which is kept alive, has, in the higheſt degree, the virtue, in which they are moſt intereſted, namely that of laying the moſt eggs, and more than thoſe females would have laid, that were ſacrificed to the public tranquillity.

CLAR. I eaſily conceive it not to be neceſſary, that the Bees, which compoſe a ſwarm, ready to fly, ſhould come to an election in form, to give themſelves a head. Nor make I any doubt but they would accept her, which ſhould firſt offer. A moment, it may be, decides it. I mean, that among the late born females, ſhe, who is ſufficiently active, and reſtleſs to part firſt from the hive, may determine the Bees, who no longer like their old habitation, to put themſelves in her train, in the ſearch of a new lodging.

EUGEN. I am of your opinion. We may however ſtill add one circumſtance, very capable of determining a choice ſo bounded in its views

as theirs may be. It ſeems the ſovereignty may be granted, as in our moſt famous monarchies, to the Bee, which, by its birth, can lay the beſt claim to it. The firſt is ſhe, who has acquired the moſt vigour, who has been the ſooneſt impregnated, and the moſt ready to lay. This title would be ſufficient to merit a throne among the Bees. I think I have even a proof of it.

CLAR. Trifling as thoſe motives may be, which lead them to the choice of a ſovereign, they will be always more reaſonable than thoſe of a people, who ſet their crown to ſale.

EUGEN. I am not, any more than you, diſpoſed to approve that method of giving themſelves ſovereigns. Could you, however, ſuſpect the Bees to be captivated by the brightneſs of gold? Virgil has deſcribed the King they have choſe, as a perſon of grand air, and all ſhining with gold; and the abandon'd kings, as hideous and of an ignoble figure. This figure is not abſolutely foreign to probability. I have always obſerved the choſen queen to be of a more reddiſh colour, than the reſt. This colour was ſufficient to create gold in a poet's eyes, and perhaps may have the ſame effect on the eyes of the Bees: for thoſe, who are put to death, have always appear'd to me more brown, and not ſo large. So Ariſtotle has affirm'd, that the elected king is red, the other black, that is more brown. This conſtant difference of colour may a little juſtify the exaggerations of Virgil, and give

give the Bees a motive for their choice, which is determin'd as their eyes are affected. However, this reddiſh colour is not an advantage beſtow'd by nature, and given preferably to ſome rather than to others, to mark out ſuperior merit; 'tis only a prerogative of age: the mothers, like other Bees, become redder as they grow older. When they are firſt born, they are browneſt: the nearer they are to their laying time, the bigger and larger their bodies are, and the more ſhining. From hence it appears, that ſhe, who is preſerv'd for queen, is the firſt born and the neareſt laying, becauſe ſhe has a higher colour, and an air of grandeur ſufficient to ſtrike the eyes of the other Bees. Thus royalty among them would be due to *primogeniture*, and the reward of fruitfulneſs.

CLAR. The choice, which the Bees make of their queen, leads me to ſuggeſt to you a little reaſoning of mine, on this ſubject. I like, that one ſhould reduce, as you do, the actions of animals to their juſt value. I can't bear, that people ſhould endeavour, as I, every day ſee thouſands do, to raiſe the intelligence of beaſts to an equality with ours, and continually compare us with them: this parallel has always ſhock'd me extreamly. In a diſpute, which I have often had with Madam *** who, like ſeveral other women, knows nothing better than what ſhe thinks; this good lady, always in an extaſy on the pretty manners of her dog, will have it to act from a reaſon ſimilar to her own.

If

If I offer to contradict her with politeneſs, ſhe ſtrikes me dumb with this fine argument: This muſt be ſo, becauſe neither you, nor myſelf, can conceive how it can be otherwiſe. It is to no purpoſe to reply, that the bounds of our conception are not thoſe of omnipotence; and that if omnipotence could be bounded, there would be an end of all argument. That beaſts perform mechanically that, which we can't perform but by the aſſiſtance of our reaſon: and certainly, I don't, on that account, leſs admire the author of nature. I think it too great a raſhneſs for men, to imagine, that every thing, which has a reſemblance of reaſon, can't be effected but by a reaſon ſimilar to theirs; as if God was not ſufficiently powerful to accompliſh his own ends by a diverſity of means.

EUGEN. If you would pleaſe to take the trouble oftener to give us arguments in your own manner, our converſations would be much the better for them.

CLAR. You are very obliging. Since we are on the ſubject of the actions of Bees, I will propoſe one queſtion concerning the maſſacre of the queens. Is it on the account of the Bees lately ſettled in their hives, that the mothers are put to death? How will that agree with the affectionate concern, which is well known they have for all the mothers in general? Is it not more likely, that the two mothers, jealous of one another, ſhould fight each other; and that the weakeſt ſhould be the victim?

EUGEN.

EUGEN. That is what I could never ſee. What would make me think, that the two mothers, though naturally very pacific, attack each other, is, that they are arm'd with ſtings, which they have ſcarcely any other occaſions to make uſe of; for they don't uſe them againſt the Bees of their own hive. However, in ſpite of all the reſpect, which theſe laſt have for their queens, in ſpite of the love they teſtify towards them, there may be times and circumſtances, in which they don't heſitate to take away their lives. You will preſently ſee, that after they have taken infinite care of thoſe maggots, that would become Male-bees, there is a time, wherein they make a dreadful carnage of them: this is an article, that can't be better plac'd, than after this, which we have been juſt treating of. Let us reſume our plan, that we may not wander from it. We have parted from a new lodg'd ſwarm. If this ſwarm come into its hive, with ſeveral queens, I have told you, that before they apply themſelves to work, they proceed to the choice of their ſovereign, and that the other candidates are deſtroy'd. The drones, or males, who have followed this colony, are treated with more indulgence. They remain with this only queen; they are ſuffer'd to enjoy the ſweets of life about ſix weeks, reckoning from the day of their tranſmigration.

CLAR. The reſpite, with which the drones are favour'd, appears to me an effect of pure goodneſs on the part of the working-bees. I do not know what good can accrue to them, to maintain, for ſo long a time, theſe idle creatures,

tures, which are of no ſervice to the ſociety: I have not forgot, that one queen does not put herſelf at the head of a ſwarm, till after ſhe has taken care, in her old hive, to be in a condition to lie in now; and that ſhe actually does ſo, the day after her arrival there. Theſe males, therefore, are of no other ſervice to her. Does ſhe keep them as huſbands, *ad honores*, for the dignity and honour of her rank, and as the Eaſtern princes do their ſultans?

EUGEN. It is not probable, that this luxury, or, rather, this debauch of mind, has intruded itſelf among animals. It is true, when a queen leaves her old hive, ſhe is already in a condition to perpetuate her ſpecies. But it is likely too, that the prodigious number of eggs, that ſhe has in her body, requires the drones to ſtay ſome time with her. The Bees are too good managers of their labour and their proviſion, to maintain, for ſo long a time, thoſe lazy bellies, which contribute nothing to the public good. What proves it is, the diligence, with which they get rid of them, when the time is come. 'Tis likely, this time is noted to them by the perfect indifference, with which the queen begins to treat theſe males. The workers, who take notice of it, then declare the moſt cruel war: for three or four days they make a terrible butchery of them. Notwithſtanding the ſuperiority, which they ſeem to have by their bulk, they can't hold out againſt the workers, who are arm'd with a poignard, which conveys poiſon into the wounds they make.

Beſides,

Beſides, the number of thoſe, who attack, are conſiderably more numerous than the attacked, and they are not aſham'd to join, two or three together, againſt one. While theſe days of carnage laſt, one ſees them, from morning to night, incenſed againſt the males, which they draw from their hives, dead or dying. During the ſix weeks the males continued in the hive, with the queen, ſhe fail'd not to lay eggs of both ſexes. The moment of their proſcription come, there are found males of all ages in the hive, and ſome in their cradle, which till then were nouriſh'd with the tenderneſs of a mother, and ſome there are which be ſtill in their egg. The law of the ſtate, which has pronounc'd the deſtruction of the males, has no exception; it extends equally to thoſe, who do not yet breath, as to thoſe who do. The whole ſex muſt be totally deſtroy'd, and is ſo. Love changes into fury; hate ſucceeds maternal fondneſs; the workers make a narrow ſearch in all the *Alveoli*. Whatever is a male maggot, as well as that which is only likely to be ſo, all is torn away, butchered, diſperſed, and carried off into the high ways; the hive is cleanſed of them, as it would be from a contagion. It becomes then a theatre of horror and of murders. There are hives, in which, this carnage takes place ſooner; others, where it is later, according as the ſwarms are, which have enter'd there. One ſees this in the months of June, July, and Auguſt.

CLAR. We have ſuſpected the queen to have convey'd a criminal ſting into the boſom of the other queens, her rivals: could one have believ'd her likewiſe guilty of the death of her huſbands?

EUGEN. I have no reaſon to think ſo; and, if any thing could determine me to pronounce her innocent of theſe terrible executions, it is, that ſhe is not at all intereſted in them. The drones are too great cowards and too indolent to give her umbrage, or diſpute her rank. You know the funeral dues, which one of theſe queens paid to one of her dead huſbands at my houſe.

CLAR. I ſhould rather have ſuſpected her of too much tenderneſs than guilty of cruelty. We are doubtleſs come to the laſt act of the tragedy. I hope you will now efface, by more agreeable relations, the black and melancholy images, with which my imagination has been filled.

EUGEN. You were willing to know, Clariſſa, the life of Bees; you order'd me to give you a recital of it. To retrench the circumſtances proper to characterize them, would not be the way to anſwer what you expected from me. There are ſtill wanting, to what I have juſt now ſaid, certain traits, which I ought not to omit. You know the love of the common Bees to the maggots born in their hive. I thought it would be curious to know, whether this love would be extended towards thoſe maggots, which took their birth in another. To inform myſelf of it, I one day, convey'd

convey'd into ſeveral hives, parts of combs, which I had taken from others, and whoſe cells were filled with the eggs of maggots of every age, and with *nympha's*. The *nympha's*, having no farther need of the aſſiſtance of the common Bees, became Bees, in their new hives: they there procured for themſelves, in a moment, their freedom, and augmented the number of their inhabitants. But I did not ſee the Bees of theſe hives take any care of the foreign eggs and maggots; they even treated theſe laſt with the utmoſt barbarity; they tore them from their cells, and threw them away. There are ſtill ſome caſes, in which they treat the maggots, born among them, in the ſame manner. It is, when a comb falls down, by ſome accident, or ſome part of a comb, the Bees are ſeen to collect themſelves together; nor do they ſpare any of the maggots found in the open cells; they tear them out, kill them, and throw them far off.

CLAR. In this there is not only an inſufferable barbarity, but a crying injuſtice. Why muſt theſe little innocents pay, with their life, the folly of their parents? Are they guilty of the fall of the combs, which, perhaps, fell, becauſe they were ill faſtened?

EUGEN. I will not attempt to juſtify this procedure; but there is reaſon to imagine, that the maggots of the fallen combs would never ſurvive. The cells of theſe combs, in their firſt poſition, had their axis almoſt horizontal; but when fallen it became vertical. You give me to underſtand, that

that when we talk to ladies, we ought to uſe clearer terms. I will do ſo. The moſt advantageous poſition of our new-born infants is to lie along: they would periſh in a little time, or, at leaſt, would ſucceed ill, if they were placed in an upright poſture, and their legs loaded with the weight of their little bodies. It is ſo with the maggots we ſpeak of. In fine, (and this is the moſt ſtrange adventure, and which cauſes the greateſt horror with regard to cruelty,) it ſometimes happens, that the Bees of certain hives tear the maggots from their *alveoli*, kill them, and carry away their bodies, though no accident has befallen the combs; though we can ſee no reaſons, that can determine them to practice theſe cruel extremities, ſo oppoſite to the tender affection, which they commonly ſhew for thoſe of their own hive. 'Tis juſt as if mothers, forgetting at once their natural tenderneſs, ſhould butcher their children in cold blood.

CLAR. Are you reſolved, Eugenio, to make me quarrel with the Bees, to avenge yourſelf of the trouble I give you in telling me their hiſtory?

EUGEN. I am not at all revengeful; but I would not be reproached to have left you ignorant of things eſſential to be known. It was my duty therefore to inform you of this barbarous practice. But a little to efface the blackneſs of it, one can't but think ſuch a procedure is founded on good reaſons, ſuch as the Bees could inform us of, if they could plead their cauſe before us.

us. Among others which I gueſs at, the too great fruitfulneſs of their queen may be one. I have told you already, that part of the *alveoli* are deſtin'd to receive thoſe eggs, which the queen is to lay; and the other for the crude wax and honey they lay up in reſerve, as well for the daily nouriſhment of the Bees, whom their works in the hive keep at home, as for rainy days and winter, when they can't ſtir abroad. But if a queen is ſo fruitful, as to take up all the *alveoli* with her eggs, at a time, which invites them to gather in their ſtores, nothing remains to be done between theſe two equally bad extremities; namely, to preſerve the maggots, and expoſe all the people to the hazard of periſhing through want, in neglecting to make proviſion for their ſuſtenance; or to ſacrifice thoſe maggots, in order to employ their cells, for laying up proviſions to nouriſh the people againſt a time of neceſſity. Now the latter of theſe is certainly more conformable to the publick good.

CLAR. If this be the reaſon, which influences them, I can't blame them; for I agree with them, the ſafety of one's country is the ſupreme law, to which the ſafety of particulars ought to give place.

EUGEN. I am the more inclined to judge in their favour, becauſe I have remarked it to be on thoſe days, in which they could more eaſily, and in a ſhort time, make great collections of honey, that I have ſeen them make theſe bloody expediti-

ons. Now obſerve another circumſtance, wherein they make a carnage of the maggots.

CLAR. Still another carnage!

EUGEN. This will be the laſt, and which, like the former, does not merit your reproaches againſt their cruelty. When their numbers are ſo great in the hive, that they find difficulty to lodge themſelves there, and their queen no longer lays theſe eggs, from which queens are to be produced, or thoſe, which ſhe has laid, have had ill ſucceſs; this is an unlucky event, and which would embarraſs the hive, and is to be guarded againſt. I will not ſay, that our Bees reaſon and foreſee, but that they act as if they did both. Obſerving then, that they ſhall be deſtitute of a queen to conduct their colony, they prevent, by deſtroying the maggots, the number of Bees from multiplying too faſt. It may be too better reaſons, than we are acquainted with, force them to this cruelty. We are not ſure thoſe maggots, which appear to us ſound, are not in a diſtemper'd ſtate; and that the Bees, into which they would be metamorphiſed, would not be too weak. And how many other reaſons are there, which we know not, and with which they are better acquainted than we? You ſeem deſirous of finiſhing a converſation, which has laſted too long, and has given pain to your ſympathizing, compaſſionate heart.

CLAR. I have not ſuffer'd it, but on condition, that you would efface, as ſoon as poſſible, by gay and pleaſing ſubjects, thoſe melancholy ideas,

ideas, with which you have filled my imagination.

EUGEN. I promiſe none but ſuch, as will be found in the order, which our hiſtory in general requires. But before we part, I muſt inform you, that the two rules, which I laid down as general among the Bees, namely, that there is never to be found above one queen in one hive, and that they kill all the males ſix weeks after their arrival there, admit of exceptions. I have ſometimes found two queens in one hive, but the caſe is very rare. It may happen in one, where the Bees, ſuperior to their labour, ſhall judge they have nothing to fear from this multiplicity. I have myſelf put ſeveral into hives, where they have, at firſt, been well received, and even careſſed and maintained for ſeveral days; but their end has always been fatal. With regard to the males, it ſometimes, though rarely, happens, that the workers do not kill them all, at the prefixed time: whether they deſpairing of ſucceeding, conſent to a peace; or whether a confidence for the weakneſs of their queens prevails with them, to leave them alive. Then theſe males paſs the autumn in the hive, and, at leaſt, part of the winter. This is a well-known fact among thoſe, who deal in Bees; but ſo far from foreboding ſucceſs to theſe hives, they conſider them as loſt. They fancy their loſs proceeds from the males eating up all the honey, reſerved for their winter ſtores. In this they are miſtaken. It is more probable to believe, the eggs ſuffer alteration in

the body of their queen, who lives with theſe drones a good while beyond the time fixed by nature. In a word, it is a derangement of the natural order; and whatever cauſe 'tis owing to, it is certain, that all thoſe hives, in which the males have ſpent the winter, periſh in ſpring. The firſt work of a ſwarm new ſettled is to reduce the number of their queens to one only. That is what we have already ſaid. The ſecond is to build and frame their habitation. This is what I have to inform you of the firſt opportunity; and will begin with the *propolis* and wax, which are the principal materials of their ſtructures.

CON-

CONVERSATION X.

Of the propolis *or roſin, with which the Bees cloſe the clefts in the hive of the wax.*

CLARISSA.

WE ought to have been here, Eugenio, three hours ago. If it had not been for the troubleſome viſit of our very idle neighbours, we ſhould already have ſeen a hundred charming things. They have made us loſe the fineſt time of the day, and the moſt commodious to ſee the labour of an hive. I am afraid, as it is now five o'clock, we ſhall find our Bees fatigued with their day's work, and diſpoſed to take that reſt they have need of.

EUGEN. Though it is late, we may yet find enough to ſatisfy our curioſity with. As the Bees know how to divide among themſelves their different works; they likewiſe know how to divide, at different times, the works of a different nature. The evening is paſſed in things worthy of obſervation, and which would be difficult to be met with at another time, as is, for inſtance, their gathering of the *propolis*. To make you the better comprehend, wherein this collection conſiſts, and for what reaſon I ſpeak of it, let us reſume the ſeries of thoſe things, we

discourſed about yeſterday. You will agree, Clariſſa, that I ought not to have ſpared you theſe tragical recitals, which made the ſubject of our laſt converſation. A traveller, who undertakes to deſcribe faithfully the manners of an unknown people, can't be diſpenſed with from giving an account of their laws, as well thoſe, which have a tendency to make the people happy, and rich, by their labour and induſtry, as thoſe, which are made to keep every one to their duty, and cut off from the civil ſociety the citizens, who diſturb or prejudice it. It is the laws and cuſtoms of nations, which characterizes their genius. The firſt philoſophers, who only ſtudied as they travelled, collected, by way of preference, the laws of various people, through which they paſſed: it was from this collection they drew the principal maxims of their wiſdom. We have ſeen ſome of the Bees laws, which tend to retrench whatever is found prejudicial to their ſociety: we are now to treat of that, whoſe only aim is the eſtabliſhment, the multiplication, and preſervation of the ſtate.

CLAR. This policy of theirs you will now entertain me with, will be more to my mind, than that, which was wholly taken up in the diſtribution of pains and puniſhments.

EUGEN. Immediately after the arrival of a ſwarm into its new hive, where there is but one queen, all the people diſpoſe themſelves, and, in an inſtant, run to their different employments: if there be a plurality of queens, the firſt thing they think

think on, before they apply to any work, is the choice of her, who ought to reign. When the election is made, and the pretenders to the ſovereignty have, in loſing their lives, reſtored peace to the ſtate, they apply themſelves to the building of their cells. It muſt be remarked, that the Bees muſt have an incloſure ready made there, to depoſite their combs. Nature, who knew they would eaſily find one, has diſpenſed with them from making it. A hole of a wall, or a trunk of a tree, are commonly the places they chooſe, when they can procure no better.

CLAR. I one day found a ſwarm, which had ſettled themſelves between the two frames of my cabinet.

EUGEN. It was a glaſs-hive, which chance had procured you, and of which you might have made good profit.

CLAR. I might; however I did not; it was when I was young, and at that time, when objects only ſpeak to the eyes, and don't affect the underſtanding.

EUGEN. At this time, that you have your ſight, as I may ſay, more knowing, we ſhall have occaſion to make a better uſe of it. Let us place ourſelves on this form over againſt our hive, to have recourſe to it on occaſion. If we ſuffer the Bees to place themſelves in fixed and immoveable places, as walls are, we can't commodiouſly make an advantage of their labour, and procure their wax and honey, which we eaſily do, when we preſent them hives of our own

making, which are called *baſkets*, ſuch as thoſe before us: for we have nothing to do but to overturn theſe, in order to get their combs. When therefore a ſwarm is entered into one of theſe hives, or baſkets, of whatever faſhion it is, ſome of the Bees, that moment, apply themſelves to build their *alveoli*; ſome to ſtop exactly all the holes, clefts, and crevices, that are found there. Theſe are the two firſt labours of our Bees, with which I ſhall now entertain you. Their habitations ſhould have no other openings, but ſuch as ſerve for doors: every where elſe they ſhould be cloſe. Our Bees have reaſon to fear leaſt thoſe inſects, which covet their honey, their wax, or themſelves, ſhould find paſſages for their entrance.

CLAR. Have the Bees then, like ourſelves, thieves and aſſaſſins to fear?

EUGEN. 'Tis the common lot of all living creatures. I know of no animal, which may not be the prey of ſome other. It is more eaſy for the Bees to oppoſe themſelves to the incurſions of their enemies, when they have but one, or, at moſt, two gates to guard. In fine, the entries ought not only to be ſhut againſt inſects, but againſt damps, air, and even inſinuating winds.

CLAR. Here is a great deal of delicacy in animals ſo laborious and warlike.

EUGEN. It is of great conſequence to them to be lodged very warm, which is a thing I will ſome time ſhew you. The matter, with which the Bees ſtop the openings and crevices of their hives, greatly deſerves to be known. It is not

the ſame, with which they compoſe their wax, nor is it the wax ready made: 'tis of quite a different kind, that has no need of being work'd up, and which they know how to find, ready prepar'd, on plants.

CLAR. They have ſo good a manufacture of wax, and wax is ſo commodious for ſtopping of holes; wherefore then do they give themſelves the trouble of ſeeking other materials?

EUGEN. The oeconomy, with which they employ their wax, gives us room to think, that this collection is not ſo eaſy to them, as you may imagine. But the matter, with which they uſe to cloſe their hives, is much more commodious for the uſe it is deſign'd for. It is a roſin eaſy to be rolled out, fixes itſelf more eaſily, and has a good deal more tenacity than wax, and, beſides that, requires no preparation. It was known to the antients by the name of *propolis*.

CLAR. *Propolis?* That name is not unknown to me. I remember one day, it was uſed with ſucceſs, in a drug, which had that name, on one of my children, who had received a wound. They talk'd very magnificently of it, which made me have recourſe to my dictionary of ſimples, which gave me a very particular explication of it.

EUGEN. In which, however, I would not adviſe you to acquieſce.

CLAR. How ſo? It did a great deal of good to the patient, and perfectly cur'd him of a dangerous wound.

EUGEN.

EUGEN. That is what happens every day; one reaſons very ill on remedies, that are apply'd very well. Experience informs us, that men know how to apply them, but not what they are. This dictionary treats of the *propolis* as virgins wax, or a kind of maſtick that the Bees make. The *propolis* is nothing elſe but a roſin, which they collect from trees, and which they employ as they find it, without being forced to make any change in it. It is thought to be from poplars, birch, and willows, that they collect it. I have, however, ſeen them in countries, that had none of theſe trees, and they employ'd the *propolis*. It has not been my fortune, as yet, to meet it on plants, where the Bees know where to look for it; that is a diſcovery yet to be made, and which, perhaps, is reſerv'd for you.

CLAR. Could you bear, that a woman ſhould ſnatch away this glory from you?

EUGEN. I ſhould only diſpute the honour of being the firſt to ſhew my gratitude. However it be, the *propolis* is a roſin, eaſily diſſolvable in ſpirits of wine and oil of turpentine, which grows very hard in the hive, but which may always be ſoftned by heat. That which is found in different hives, and even in different parts of the ſame hive, offers not only a great variety, with reſpect to its conſiſtence, but likewiſe as to its colour and ſmell. It commonly diffuſes a very agreeable one when it is heated; nor is it unfrequent to find it of an aromatick ſmell; and ſome that might deſervedly be rank'd among perfumes.

Its

Its outward colour is a reddiſh brown, ſometimes clear, ſometimes deep: its interior, when broken, reſembles wax, and is a little yellowiſh. At the time when the Bees make uſe of it, it is ſoft, and as pliable as bitumen, to careen the hive. I ſuppoſe you know the meaning of that word.

CLAR. My ſcience goes thus far. They are ſaid to careen ſhips, when they rub them over with ſuet or pitch and tar, to make them impenetrable by the water.

EUGEN. That is it: the *propolis*, therefore, being very tenacious, and having the viſcouſneſs of a gluey kind of roſin, which ſticks to the fingers, is very proper to be thus applied. When it has once been ſo, it grows every day more conſiſtent, and becomes much harder than the wax. I muſt now let you ſee, how far the Bees give it the preference, to other materials, which, to us, would appear equally good for ſtopping the hives. Obſerve the rims of your glaſs-hive.

CLAR. I obſerve, that you ſtuck there, on the inſide, ſlips of paper, as we do on the ſquares of our windows; and that you have very likely repented of it, ſince you afterwards tore them off. This is what I learn from thoſe fragments, which ſtill remain ſticking on the glaſs.

EUGEN. It is true, that I had ſtuck ſlips of paper on the hive, before I introduc'd a ſwarm. I well knew the Bees would deſtroy my work, and that is the thing I would have you obſerve. We and our glaziers, are but bunglers in compariſon of them, in cloſing and ſtopping the

ſquares

ſquares of windows: the Bees have more ſagacity in this, as well as in other particulars, than we have. For this reaſon they cannot bear that we ſhould interfere in their affairs. It was they that tore off theſe bandages of paper, and hack'd them at this rate, to ſubſtitute, in their room, their own roſin. See, there is one yet at work this moment, to let me ſee what I had done ſignifies nothing. Let us draw nearer, to view her the better.

CLAR. I ſee her perfectly. I fancy I obſerve by that vivacity, with which ſhe deſtroys the remains of your work, that ſhe is in great wrath, and accuſes you of being a very ill-adviſed perſon. She is probably going to careen the whole place that ſhe has laid open.

EUGEN. Whether ſhe or ſome other does it, the opening will certainly be clos'd. I will not however anſwer, that ſhe will take for that the time, which will ſuit us. The Bees neither obſerve our orders, nor our hours. They labour at this work in the night, as well as in the day. But I diſcover another, which will give us the ſight, in part of what we look for. Obſerve below there, on the ſtand of the hive, two Bees, which keep a third in a corner, and ſeem to rob her. They haul her as two robbers would do a paſſenger, at the turning of a ſtreet.

CLAR. You have already told me, that they ſometimes tear the bread out of another's mouth: if this be the preſent caſe, I know the deſign.

EUGEN.

EUGEN. 'Tis quite another thing, the plunder in queſtion is a charitable ſuccour, which the Bees afford one to another, on the account of the *propolis*. Stoop down. This ſight will give you pleaſure, and we ſhall owe the obligation of it to the impertinent viſit, which oblig'd us to come here later than ordinary. Three hours ſooner, we ſhould not have had the pleaſure of ſeeing this: for I have very often remark'd, the Bees chooſe the morning, preferably, for the gathering of the crude wax, and the evening for the *propolis*. I ſay preferably, and not excluſively.

CLAR. Lend me your magnifying glaſs, Eugenio, to obſerve nearer theſe officious Bees, which plunder their companion, out of charity. I will begin this very day, to ſee learnedly. I am going to give an account of what I obſerve, and you ſhall tell me frankly, if I make a right obſervation, and if there be any hopes of my becoming a good naturaliſt. Hear the relation. I ſee a Bee between two others, which pull her by the claws. Good heavens, how they lug her! They will tear off her legs.

EUGEN. Obſerve, carefully, if it is by the legs ſhe is ſeiz'd.

CLAR. You are in the right, I was miſtaken; they each of them tear away ſomething that ſticks to her legs. I now ſee what it is. It is the very *propolis*. I know it by its colour, by its reddiſh brown. Each of theſe two make ſtrong efforts, to pluck away this matter; they

pluck it away with their teeth; the *propolis* gives way, and draws out in length, like a thick gum. The patient ſuffers all this without complaining. There is one, who has juſt got off part, and flies away with its booty. I ſee another, that comes to take its place, and which requires ſome for its ſhare. The little ball diminiſhes of its ſize inſenſibly. The purveyor ſhould, methinks, ſuffer a good deal; for it ſeems to me, this roſin cannot be got off, without conſtantly tearing the hairs that ſurround it, and keep it on.

EUGEN. All that is well obſerved. Now take notice, on what part of its body the Bee carries this *propolis*.

Plate XI. Fig. 7. Lett. B.

CLAR. It is in the baſket you made me obſerve, that ſhe piles up the matter, of which wax is made, in that hollow, at the third articulation of her hindmoſt legs. I give you back your glaſs. Methinks this is not amiſs for the firſt time.

EUGEN. If you don't become a naturaliſt, you will reproach yourſelf all your life, in being wanting to what you are ſo well fitted for. Now you underſtand the ſubject ſo well, you will comprehend, with more eaſe and ſatisfaction, one obſervation of the ſame kind I formerly made. I order'd a hive to be made, on the top of which was placed a moveable ſtopper. The Bees, who took notice of it, ſealed it with their *propolis*. An experiment I was willing to make, requiring I ſhould take off this ſtopper, requir'd likewiſe, that after I had put it in its place again, it ſhould

ſhould not ſtop the hole intirely, ſo that part of the *propolis*, with which it was maſticated, was found outwardly. As it had not been long, ſince the Bees had ſealed it, this roſin was yet freſh. The Bees, which obſerved it, judg'd they might ſpare themſelves the pain, to go farther in the ſearch of it. I ſaw two or three of them, who came to get their ſhare of it, and one among the reſt ſtaid there a long time. This Bee was placed the moſt favourably in the world for me; ſhe gave me the intire pleaſure of obſerving the collection ſhe made of it. This tenacious gum, which had been a little dried, ſince it had firſt been us'd, did not yield but to the redoubled efforts of the Bee: nevertheleſs, it at laſt became pliable. The Bee loaded herſelf with it: ſhe made on every leg a ball of enormous bulk: thus ſhe was employ'd a good while. A long half hour was paſſed before ſhe could make up her bundle. This matter incomparably more difficult to get off, than the powder of the ſtamina of flowers and more troubleſome to manage, ſuffered not the Bee to go off very quick; a circumſtance lucky for obſervation. I examin'd it, with the glaſs in my hand, during the whole half hour: I ſaw, with pleaſure, how often ſhe was oblig'd to uſe her teeth and pull it, to detach a ſmall particle of this matter: at length ſhe work'd it up with them: her two firſt legs help'd her to give it its proper figure; one of the Bee's charg'd itſelf with it, and beſtowed it on the ſecond leg of the ſame ſide, which convey'd it to the third,

which applied it to the heap already begun; when ſhe had fix'd it there, ſhe knock'd it with her palet, and gave it three or four blows. It was a very pleaſing ſight, to ſee theſe little balls paſs from leg to leg. The Bee choſe the *propolis*, that was leaſt dried; ſhe ſuffer'd ſome fragments to fall, that ſeem'd to her too dry, and neglected them, as not being any longer fit to be work'd up.

CLAR. I have a thought, which will prove I am become a philoſopher, and that too of the beſt ſort, that which you approve, and is conducive to the public good. Pharmacy is in poſſeſſion of the *propolis*, for the advantage of our bodies: Can't arts and trades divide with philoſophy the honour of drawing from thence ſomething, that may be uſeful in common life?

EUGEN. Your notion is a very good one: I had the ſame idea, and have made ſome experiments, which have inform'd me, that *propolis* diſſolv'd in ſpirits of wine or oil of turpentine may be ſubſtituted in the ſtead of that varniſh, which is uſed to give a golden colour to ſilver or tin reduced to thin plates. If, for example, it is incorporated with maſtic or ſandarac, it will be very uſeful to gild leather.

CLAR. What do you mean by making gilt leather of varniſh: is there ſuch a thing as gilding without gold?

EUGEN. Perhaps you think, thoſe fine beautiful hangings, with which your parlor is adorn'd, are enrich'd with real gold.

CLAR.

CLAR. I frankly own, that I thought ſo 'till now, and that it was leaf gold, like thoſe that are laid on the frames of our pictures. I even hoped, that, in caſe of neceſſity, one might have ſome little relief from thence.

EUGEN. The proverb, that tells us all is not gold that glitters, is, in this caſe, literally true. The art of making hangings of gilt leather informs us of the ſecret of gilding without gold. The gilding of theſe leathers, which are ſometimes very beautiful, depends upon a varniſh, which, when in a lump, is of a brown colour. After one has cover'd thoſe parcels of leather, that are to be gilt, with leaves of poliſh'd tin, the varniſh is laid over theſe leaves; in a moment they appear to be that precious metal, which arms one part of the world againſt the other. The white colour of the tin, which appears through the varniſh, and is mix'd with it, compoſes a ſhining perfectly reſembling gold.

CLAR. Farewel then my hopes. For one knowledge more, I have one hope the leſs. I know not, Eugenio, if I am a gainer by this change.

EUGEN. A pretty ſubject to reaſon upon *pro* and *con!* But we have ſomething elſe to do to day. Let us finiſh our propolis. It is not only uſeful for Bees, to cloſe exactly their habitations with: they apply it likewiſe to another purpoſe, which manifeſtly ſeems to prove, that theſe wonderful little animals reaſon to a certain degree, and that they know, as well as we, to deduce

conſequences. Obſerve the fact. They ſuffer as little as poſſible, foreign bodies in their hive. When they find any ſuch, not ſuperior to their ſtrength, they carry them out. Notwithſtanding it ſometimes happens to inſects, and more particularly to ill adviſed ſlugs, and ſnails not not well inſtructed, to inſinuate themſelves as far as their waxen combs. Is it at all wonderful, that the Bees do not ſpare ſuch heavy animals, or that they kill them with their ſtings. But what is to be done with them after they are dead? They can never think of tranſporting ſuch heavy bodies: they know, however, theſe bodies will putrify, and from this putrifaction a bad ſmell will ariſe, which will be deſtructive to them. See the inconveniency, from which they are to guard themſelves. What would you do, Clariſſa, in the like caſe?

CLAR. I would leave my lodgings, and ſave myſelf among my neighbours.

EUGEN. The Bees are better adviſed. Not to be obliged to break up houſe, and abandon what, to them, is the moſt valuable, they embalm theſe dead bodies, and cover them all over with propolis. M. Maraldi tells us, that he ſaw a ſnail, that they had entirely cover'd. I have often, myſelf, ſeen the like. I have ſeen ſome ſlugs, whoſe ſkin hath been a little dried, and which they embalm'd like ſo many mummies. I obſerv'd, one day, that they employ'd the ſame materials, for a like end, and with more oeconomy, upon a ſnail. This weak animal,

having enter'd into one of my glaſs-hives, had fix'd itſelf on one ſide of the ſquares of the windows, where he patiently waited, till a moiſt air ſhould invite him to march on. The Bees, not able to chaſe him away, faſten'd him more ſolidly there, than he would have fixed himſelf, and more ſtrongly than he deſired: they applied a girdle of propolis all round the extremities of its ſhell, with which he was maſticated againſt the glaſs. When he afterwards wanted to diſengage himſelf from his voluntary priſon, where he had plac'd himſelf, his efforts were found unavoidable: All the viſcous liquor, that he had diſgorg'd, was not capable to ſoften the propolis; he was obliged to periſh where he was fixed.

CLAR. I agree that this induſtry, and this foreſight of the Bees, have ſomething wonderful in them.

EUGEN. You, who like we ſhould reduce the actions of brutes to their juſt value, and have ſo much repugnance at hearing that animals reaſon like us, how will you now do, not to put us on a par with them?

CLAR. Upon the whole, that is embarraſſing; but it will always be reaſonable to ſay, that the creator of all things has ſufficient power to accompliſh his own ends by a diverſity of means.

EUGEN. Your ſolution is likewiſe mine. Nature, like religion, has its myſteries. I put a great difference between examining the actions of animals, and knowing the principles of their actions. In the firſt we admire the works of the

Almighty; it is there, that he would have us know him: in the other, it appears, that we ſearch to know the ſecrets of the Creator, and enter into his councils; a curioſity ſo much the more ridiculous, as it is unavailable. We propoſed to ourſelves, to day, to examine the two firſt labours of a new hive; namely, that of keeping the encloſure, into which the Bees muſt enter, cloſe and inacceſſible to outward enemies, and the other, the ſtructure of the *alveoli*. I have juſt told you, in relation to the firſt, all that I know of it; let us now proceed to the ſecond. An *alveolus* preſents two different objects to be conſider'd, the matter and the form, that is, the wax, and the rules, on which the *alveolus* is founded. To begin with the wax. Shall I repeat, Clariſſa, what I have already ſaid on this ſubject?

CLAR. I will myſelf tell what I remember of it, that you may judge if your ſcholar anſwers your care and expectations. There is crude wax, or the materials of which it is made, and wax properly ſo called. The crude wax is the powder of the *ſtamina*: it is this colour'd powder, that ſticks to one's fingers, when the ſprigs are ſqueez'd, which lie at the bottom of the cup in flowers: the real wax is that, which the Bees have made, ſuch as we take from the hive. See the whole of my knowledge: if you are deſirous I ſhould know more, you have nothing to do, but to inſtruct me.

EUGEN.

EUGEN. It is all I have, at preſent, told you. Now we are going to examine it more minutely. You might doubt, if the duſt of theſe *ſtamina* were not the real wax. You muſt judge by yourſelf, what it is. I ſeiz'd, this morning, a Bee coming from the fields: ſhe was loaded with this crude wax. I kill'd her without allowing time to get rid of her loading; this is ſhe. You ſee two little balls of wax, which are yet attach'd to her hind legs. Let us take theſe balls off. Make them up only into one lump. Now they are united, work up this little bowl between your two fingers, as you would work up wax; endeavour to reduce it into a flat thin plate. Have you done it? Plate III. Fig. 3. Lett. A A.

CLAR. By no means. I ſee plainly, that this is not wax; for the common wax grows pliant, and becomes flexible like paſte: that is ductil, and this little ball is not ſo; it does not at all grow ſoft betwixt my fingers; on the contrary, it breaks.

EUGEN. Take my glaſs, and conſider this matter more attentively.

CLAR. I ſee very diſtinctly it is only a collection of ſeeds, each of which, in ſpite of my repeated preſſures, and the warmth of my fingers, preſerves its round figure. They ſeem to be united together only by a little moiſture.

EUGEN. This is not then the real wax, but the principles of it: to give you the clearer proof, I will add one experiment, that I made upon that, which you have been juſt working. I

put a little bowl, formed of ſeveral little balls of crude wax, into a ſilver ſpoon, and that ſpoon upon lighted coals. If theſe little balls had been wax, they would in an inſtant been in a ſtate of fluidity, and melted; whereas they preſerv'd their figure, emitted ſmoak, grew dry, and were reduced to a coal. There is alſo another manner of making this experiment. Take ſeveral of theſe little balls of crude wax, make them up long wiſe, into a kind of thread, by rolling them with your fingers; put one end of this thread to the flame of a wax candle: you will ſee it will burn without colour, as a bit of dry reſinous wood would do. Another proof is, that if you throw this crude wax, even the moſt dried, into water, it will fall to the bottom, and there continue; whereas an equal bulk of real wax would ſwim at top, and remain upon the ſurface. It follows then, that this matter requires preparation, and that the Bees know how to work it up, but what is this preparation? Try to imagine, Clariſſa, wherein it conſiſts. How would you do, if, ſuppoſing you had the power to create a Bee, to which nothing ſhould be wanting but a ſkill to make wax; how would you do, I ſay, to beſtow on it this talent?

CLAR. If I had the power to create it, it ſeems as if the reſt would not be very difficult. We know it is provided of a very ſtrong, and ſharp tooth; I ſhould inſtruct it to make uſe of it to bruiſe and reduce into fine powder thoſe ſeeds, you call the *ſtamina*: then I ſhould provide

vide it with a particular liquor, and proper to work up this flour into a paſte, which, by the ſecret virtue of my liquor, would be turned into wax. Have I gueſſed right, Eugenio? Is it thus the Bees form it?

EUGEN. The founder of the Peripatetic philoſophy, our maſter Ariſtotle, could not have ſpoke better, and he would not have been miſtaken. 'Tis thus the antient naturaliſts often contented themſelves with imagining, that they knew what nature ought to do; inſtead of conſulting her, and following her with their eyes, by ſeeing how ſhe really acted.

CLAR. That is to ſay, in good Engliſh, that I have reaſon'd like the antients, and have reaſon'd very ill.

EUGEN. To reaſon like the antients is almoſt always to reaſon well; but with regard to natural hiſtory, and nature, 'tis almoſt always otherwiſe. I was deſirous to let you ſee by your own experience, how much one is ſubject to be deceived, when the philoſophy is drawn from the imagination; that is, when the product of the imagination is ſubſtituted to the truth of facts. Probabilities ought to be rejected, when nothing is wanting to inform one's ſelf, but to open one's eyes and ſee. But that I may conſole you for having gueſſed ſo ill, I ſhall inform you, that Swammerdam, who ſo long and ſo well made his obſervations on Bees, and ſo many happy diſcoveries, and that too with wonderful ſagacity, has gone before you in this miſtake:

his notion and yours, on the formation of wax, are perfectly conformable, and unluckily are not true.

CLAR. A fine subject of consolation, for a blind person, who tumbles, to hear that another, as blind as he, has tumbled in the same place!

EUGEN. 'Tis the best thing I can do for you. Experiment has taught me, that is not sufficient for Bees, to work up the crude wax between their claws, after they have moistned it with some liquor; it has shew'd me it is in the very body of the Bee, in which this crude wax is to be wrought; that the true laboratory is to be found there, where the conversion is made from this into wax properly so called. Some authors, who have treated of Bees, have suspected it. I think myself able to give an inconteſtable proof of this. I made a great number of trials to turn this crude into real wax, or to see, if it would not be possible to extract, by art, a perfect wax from this crude one. For it would be a great advantage for the multiplication of this matter, of which so prodigious a quantity is consumed, if we could concur with the Bees to make it likewise. But all my experiments had no other end, but to inform me, that it is not more easy to make wax from the *stamina* of flowers, than it is to make chyle from the different substances, whether animal or vegetable, which daily pass through our stomach; or to make silk from the leaves of the mulberries. I therefore had recourse to my eyes: it was by observ-

ing the Bees, that I ſaw without trouble, what you ſhall have a ſight of whenever you pleaſe. I ſaw what became of the crude wax between the Bee's claws. I am going to tell you, what my eyes diſcover'd to me.

CLAR. I begin to comprehend, that the eye is a great inſtructor, in matters of natural hiſtory; but there are novice eyes, ſuch as mine; and there are learned eyes, penetrating and obſerving every thing, ſuch are yours; and ſuch have the power of ſeeing.

EUGEN. Novice eyes, ſuch as yours, ſoon become ſkilful. One day, as I was looking on ſome Bees, going into their hive, I obſerved one of them loaded with two balls of crude wax: ſhe plac'd herſelf, at a little diſtance, on the ſtand of the hive; there ſhe kept herſelf quiet, and ſo quiet, that ſhe ſeemed to have no inclination to change her place; when, in order to obſerve her nearer, I put one knee to the ground, and approach'd her with my glaſs in my hand, to take particular notice of all her motions. I ſaw then, that there were ſome moments, in which ſhe turn'd her body round, to permit her teeth to approach her poſterior legs, and to cut from thence a ſmall portion of one of thoſe balls of crude wax. At laſt ſhe reſum'd her proper poſture, and her teeth acted one againſt the other, to grind the matter they had remov'd. Every moment this matter diminiſhed, and, in a little while, totally diſappeared. Then the teeth were immediately employ'd, to detach another

another little parcel from the ſame ball, which they ground, as they had done the former. Theſe operations were repeated more than half a quarter of an hour, at the end of which nothing remained of the ball of wax; ſhe had intirely ate it. In proportion as the teeth had ſufficiently divided one part of it, the tongue, whoſe figure and place I have elſewhere determin'd, and of which have a clearer view in this deſign, (where it appears raiſed, to make it more viſible) was ready to ſeize it, and did ſo, to conduct it to the mouth. During this repaſt, the trunk remain'd in a perfect inaction; it continued folded, and inclin'd againſt the poſterior part of the head, as it always is when it does not act. Which proves (contrary to what has been thought) that the Bees make no uſe of that organ to eat their wax with. This recital, I have now made, is not that of an action, which I have only once ſeen; I have ſurprized ſeveral others in the ſame circumſtances. If you are not ſatisfy'd with this proof, I will furniſh you with an anatomical demonſtration, which will admit of no reply. In opening the belly of a Bee, lately kill'd, I will ſhew you the ſtomach and inteſtines, fill'd with this matter: you will there find, that one part of theſe ſeeds, thoſe which are not yet digeſted, retain their firſt figure; and the ſame duſt of the *ſtamina*, will ſtill be found there.

Plate IV. Fig. 2. Lett. E.

Plate IX. Fig. 1. Lett. L.

CLAR. I don't find in myſelf that philoſophical hard-heartedneſs, neceſſary to ſupport with patience,

patience the ſight of ſuch an experiment: I had rather believe you, and that you would anſwer one queſtion I have to put to you. Don't the Bees eat this crude wax, merely to turn it into real wax; or does it ſerve them for food?

EUGEN. Both the one and the other.

CLAR. How both the one and the other! Is the wax then nothing elſe but the dregs of the Bee's nouriſhment? I have known a time, wherein you have given it a nobler origin.

EUGEN. I have not changed my opinion. But you make a little too much haſte to draw conſequences from my principles. In telling you the Bees eat up the crude wax, I did not tell you what became of it, that is what I am now to do. But I perceive ſome body comes to tell us, that other cares demand your preſence at the caſtle. Let us be now ſatisfied to know, that the Bee ſwallows the *ſtamina* of flowers, and that ſhe digeſts them. We ſhall ſee, by the firſt opportunity, how ſhe changes theſe *ſtamina*, partly into wax, and partly into her own ſubſtance, together with the uſe ſhe makes of it, for the building of her *alveoli*.

CONVERSATION XI.

Continuation of the origin and nature of wax; uſe which the Bees make of it, both for food and for the building their cells. Deſcription of a cell.

CLARISSA.

I Was ſo unſucceſsful, Eugenio, in giving my opinion the other day, that I find 'twill not become me yet to ſet up for a *connoiſſeur*. To liſten with attention, to employ the whole power of my eyes, and be reſpectfully ſilent, are the diſpoſitions which I bring to this day's converſation.

EUGEN. You are miſtaken, Clariſſa. In order to learn, you muſt ſee, hear, aſk, give your opinion, contradict; and yield to nothing but evidence.

CLAR. May we not alſo yield to authority?

EUGEN. Doubtleſs. But then the aſſertion of the inſtructor, to whoſe authority we ſubmit, muſt be in the claſs of evident things.

CLAR. There I fix. The confidence I repoſe in you, my thirſt after knowledge, and my indolence, will all find their account in it.

EUGEN.

EUGEN. I would have diſpenſed with the compliment; but will not allow you to forbear ſtarting objections, whenever you may judge them neceſſary.

CLAR. That may be very eaſily done, and will well enough ſuit my inclination.

EUGEN. I will not diſpenſe with your examining, with your own eyes, whatever is capable of being ſurvey'd. For, in facts, I prefer the knowledge drawn from the eye, to that acquired by the ear. Our laſt converſation clos'd with a Bee, who, before her arrival at the hive, had ſwallowed all her proviſion of crude wax. But this is not her common practice. Frequently the Bee enters the hive, loaded with her two balls or pellets of wax; when proud of this proviſion, ſhe ſkuds up and down the combs, or ſtands ſtill upon them, fluttering her wings. You may, if you pleaſe, imagine, that the Bee, by theſe tokens, joyfully ſignifies her arrival to her companions, and invites them to come and eaſe her of her burthen; the ſequel may juſtify this ſuſpicion, which has all the probability that can ariſe from the geſture of an inſect: for immediately three or four bees draw up round, and endeavour officiouſly to eaſe her. Each of them takes, between its teeth, a ſmall portion of one of theſe balls of wax. The firſt takes one piece, a moment after a ſecond, then a third; the others doing the like. In a word, they don't quit the wax in queſtion, till they have ſwallowed it all.

CLAR.

CLAR. Methinks our Bees are very ravenous.

EUGEN. This is not done to ſatisfy hunger. Their haſty manner of eating is not owing ſo much to a deſire of nouriſhing themſelves, as to make a large quantity of honey in a ſhort time. This is manifeſt from the ſeaſon in which they appear moſt ravenous; I mean when they are to make a new ſettlement; when 'tis neceſſary for them to build a great number of cells; and conſequently to get, with all poſſible diligence, a large proviſion of wax. In the ſeaſons when neceſſity does not impell, (as when they poſſeſs a large number of combs) theſe purveyors don't meet with any of thoſe obliging Bees, who come to unload them in the way; they themſelves are not ſo urgent to work it up; they are contented with laying down their waxen burthen; after which they depoſit it in ſtore-houſes, of which mention will be made afterwards. Let us proceed with the crude wax ſwallowed by them. I before obſerved, that 'tis in the ſtomach and intrails of the Bee that it becomes true wax. I add, that 'tis in her ſecond ſtomach, ſhe having two. The ſame aperture by which this ſubſtance entred when unwrought, or crude, ſerves to diſcharge it when employed in working. This I diſcovered in manner following. I took a magnifying glaſs, and ſurvey'd attentively, through it, a Bee who was employed in building a cell. On this occaſion I perceived, that the labouring Bee did not barely move its two teeth one againſt the other,

other, or rather againſt the ſmall plate of wax held by them; but I ſaw, under the teeth, a fleſhy, whitiſh ſubſtance, that was in a perpetual, ſtrong motion; and which darted forward, and drew back, like the tongue of a ſerpent or lizzard. And indeed this was the bee's tongue, whoſe figure was perpetually changing. Sometimes it was ſharper, at other times broader and flatter; and at other times again, more or leſs concave. 'Twas ſometimes partly hid by a ſort of foam; and ſometimes by a kind of paſte or ſubſtance like pap, which the tongue, by its various motions, forced out of the mouth, and employed in lengthning the cell. The inſtant, this humid paſte was dry, (which it was preſently) 'twas juſt like our ordinary wax. I could not be miſtaken, in ſuppoſing that this paſte which the Bee diſcharged, was true wax; the inſtant I was certain, after ſurveying, the animal at work a long time, that her labours went forward; that her cell increaſed in length, without her taking wax from any other part of her body; that there was none on her legs at that time; and that the paſte ſhe drew from her intrails formed the whole work. It may happen, that the ſhavings or chips of wax par'd by the Bees, from a cell newly built, and which they repair, may ſerve to form, inſtantly, part of another cell; and I think I have ſeen the Bees uſing them for this purpoſe. But I am very certain that they can work with only new wax; ſuch as has not had time to be quite dry; and that they cannot make

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any uſe of ſuch as has acquir'd all the perfection which a very ſhort time gives it.

CLAR. Let us come to proofs, for I am fond of them.

EUGEN. Theſe may be eaſily ſupplied. In all ſeaſons of the year, that excepted during which the Bees are benumb'd with cold, whenever honey is offer'd them, they ſuck it in greedily; they chuſing to feed upon a quantity which is ſet before them, rather than draw it, by infinitely ſmall drops, from the flowers ſcattered up and down. But if honey-combs are offered them, even at a time when they have not an opportunity of getting a harveſt from the duſt of the *ſtamina* of flowers, they don't regard it. They indeed cleave or cut them ſometimes; but this is done only to get out the honey with which they are a little moiſten'd. But they never attempt to carry the wax, of which theſe combs are formed, to their hives. I have left combs (very near my hives) on which there was not a particle of honey, during five or ſix months; and I did not find that the Bees took a ſingle particle from thoſe combs.

CLAR. As you deſire that I ſhould acquire knowledge, by my eyes rather than my ears, you ſhould have ſhown me a Bee diſcharging wax in order for building a cell.

EUGEN. To give you this ſatisfaction three things will be neceſſary. To watch the inſtant, (which is not met with very often) when a Bee raiſes a cell very near a pane of glaſs: this Bee muſt ſtand full in ſight, and ſo, as not

to

to be hid by other Bees. Theſe moments are to be met with by ſuch obſervers only as are more maſters of their time than you are of yours. But I'll now offer you a readier and more eaſy expedient. We have here ſeveral hives which promiſe to ſwarm ſoon. Give orders for your being call'd, the inſtant a ſwarm flies to a tree, in order to ſettle upon it. You then will obſerve that, among the ſeveral Bees of which it is compoſed, very few will have any unwrought wax upon their legs; and theſe will be ſuch Bees only as, returning from the fields, ſhall have met the ſwarm in queſtion, and joined with them. Nevertheleſs, the moment you ſhall have hived the ſwarm, you'll find a little comb of wax, fixed to the place, left by them on the tree. Now, where could theſe Bees have taken the wax, to form this little comb, except from their intrails? For we ſee, on many occaſions, that ſuch Bees as have wax (quite wrought) in their ſtomachs, are always eager to employ it; it ſeems to annoy them, and that they frequently build with no other deſign than to eaſe themſelves of it.

CLAR. Though I ſhould ſee thoſe little combs fixed on the trees, ſtill this would not be a full proof to me, and there would yet be room for me to doubt. You grant that alien Bees will unite with ſuch a ſwarm; and that the former will have crude wax upon their legs. Why may not I ſuppoſe that theſe little waxen combs are their work?

EUGEN. I could ſhow the contrary by the ſize of the combs, which, how ſmall ſoever, will always be larger than one which ſhould be formed from the balls of wax brought by the alien Bees. But I had rather point out to you an eaſier method, which muſt neceſſarily remove all your ſcruples. Turn the Bees out of one hive into another: do this early in the morning, before any of theſe inſects have taken their flight to the fields. Being thus forced to diſlodge ſuddenly, they will not carry off any unwrought wax upon their legs, nor on any other part of their exterior. Nevertheleſs, if they delight in their new habitation, you will perceive, before night, honey-combs begun; though not a ſingle Bee went in or out all that day. Chance once favoured me with an incident ſomething like this. I had ſettled a ſwarm in a new hive. For two days together, to compute from the moment of their migration, it rained inceſſantly; inſomuch that not one Bee was able to ſtir out during the whole two days. Notwithſtanding this I ſaw, at the end of the time abovementioned, a comb fifteen or ſixteen inches long, and four or five thick.

CLAR. This experiment is more ſatisfactory to me.

EUGEN. I have made an hundred times one obſervation, which ſhews plainly, to the eye, that crude wax is not perfect wax. Thoſe pellets which the Bees bring from the fields, are ſeldom alike in colour. Some are very pale, and almoſt white; and others yellowiſh: they uſually

are

are of a beautiful yellow, others of a hue inclining to orange; others reddiſh, and others almoſt red. I have obſerved that ſome are green. The wax laid up in the ſtore-houſes, is likewiſe of all theſe colours, which are the ſame with thoſe of the *ſtamina* of flowers, when not changed; that is, when they have not been in the Bee's ſtomach. Nevertheleſs, the combs made by this crude wax, of different colours, are all of the ſame colour; an evident proof of the conſiderable change wrought by the Bees in the crude wax. This change may be compared to that which our ſtomach cauſes in aliments. What colour ſoever theſe may be; even though black as coffee or chocolate; yet our ſtomach converts them into a chyle white as milk. The ſtomach of the Bee makes the ſame operation on crude wax. Every new-made comb is white; and frequently of as perfect a white as the moſt beautiful wax-taper.

CLAR. How happens it that I never ſaw any but what were yellow or yellowiſh?

EUGEN. The reaſon is; theſe combs which come ſo very white from the Bees, loſe, little by little, and pretty ſpeedily, their bright hue in the hives: they turn yellow there; the oldeſt turn of a colour almoſt as black as ſoot. The vapours which riſe from the bodies of Bees; and from that of worms or maggots, moſt of which exhale from honey that ferments and evaporates, contribute greatly to the change of colour wrought in wax.

CLAR. This appears probable to me. I yet presume that there is a still more fix'd, internal cause, which gives this yellow hue; as art cannot whiten some kinds of wax, in the same manner as others.

EUGEN. I grant this to be true; it being but too well known to our whitsters, by whom, some sorts of wax can never be brought to a beautiful white. Hence we may suspect, that the substance of which wax is formed, is not suited, in all countries, to take a perfect white colour; whether the air, or the quality of the plants, contributes to this. This (Clarissa) is all I had to observe to you, with regard to the origin of wax; which is nothing else, (as I just now inform'd you) than the dust of the *stamina* of flowers, swallowed by the Bees; digested in their stomach; and cast up, by the mouth, in form of a kind of paste or pulp, which, by drying, becomes wax properly so called, of which they make combs: that these combs are commonly exceedingly white; that they grow yellow insensibly; but that the whitsters have found out the art to whiten them, when worked up into tapers.

CLAR. I am very much obliged to you, for deducing such a number of operations successively. But there is another I did not well enough comprehend, and of which I should be very willing to have a more perfect idea: I mean, in what manner the teeth and tongue of the Bees operate, in order to form, with the paste in question, plates or leaves of wax so very thin, and so artfully framed.

EUGEN. This is a work I could not attempt to explain. To do this accurately and juſtly, one muſt be a Bee, or have been ſuch. All I can obſerve on this ſubject is; that if you are deſirous of forming to yourſelf ſome idea from it, you need but aſſiſt your imagination by a compariſon. Figure to yourſelf that a Bee is a maſon; his ſtomach the trough in which he dilutes his white-lime plaiſter, and makes it fluid; that his tongue is the trowel which collects, beats, and lays down the plaiſter; that his teeth are hands which work it, and give it the proper form: here you will have an image very much reſembling the labour of a Bee, when building his cell. This compariſon does not, indeed, raiſe the dignity of this inſect; but 'tis the happier, becauſe plaiſter is liquid when made uſe of; and, when once dry, cannot be diſſolved by water: Wax, in like manner, iſſues liquid from the Bee's ſtomach; and, when employed, takes immediately ſuch a conſiſtence as reſiſts every diſſolvent. Fire only is able, not to deſtroy, but to ſuſpend it. To proceed now to the ſecond uſe of crude wax. I obſerved to you, in one of our firſt conferences, that the males live on honey only; but that as the Working-bees want a more ſolid food, crude wax was of great ſervice to them. This is pretty generally ſuppoſed by thoſe who trade in Bees. In Holland, in Flanders, and in Brabant, crude wax is called Bees-bread. Authors who have writ treatiſes on Bees, have thought proper to give it a nobler name, by

ſtiling it Ambroſia; and, in order that Bees might be treated, in every reſpect, like goddeſſes, they declare honey to be nectar. Pliny beſtows Greek names upon it, the acquainting you with which would be to little purpoſe.

CLAR. Say rather, that it will be of purpoſe to me not to know them; for, having a good memory, I perhaps might be ſo ridiculouſly abſent, as to employ them ſometimes.

EUGEN. I obſerved that crude wax ſerves as food to Bees; a circumſtance, which it is the the more incumbent upon me to prove, as the famous Swammerdam, that learned reſearcher into the actions and conduct of Bees, is of a contrary opinion. That able naturaliſt having examined, on one hand, crude wax; and diſcovering it to be nothing but a compoſition of little particles or grains; and judging, on the other, that the diameter of theſe particles very much exceeded that of the aperture of the trunk; he thence concluded, that the Bees could not ſwallow the crude wax; and conſequently, that they did not live upon it. You yourſelf, Clariſſa, by only recalling to mind what I before told you, may be able to refute Swammerdam's opinion. 'Tis in your own power to gain that honour.

CLAR. I'll try to do it. Let us ſee if I can recollect your lectures properly. I conceived, by the deſcription you gave me of the Bee's trunk; that this organ is not a hollow canal, nor a ſort of pump proper for ſuction; but performs the office of a tongue which draws in liquids; that

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it ſauces it ſelf, as it were, in the honey'd liquor; and, by its various inflexions, makes it flow, as through a gutter, into the inſect's throat. I remember you before gave me an opportunity of comparing the Bee to the elephant. This affinity, which now occurs to my memory, preſents itſelf with greater propriety than I at firſt imagin'd it would have done. The elephant drinks by his trunk, and eats by a mouth lying under it: the Bee drinks, in like manner, by her trunk, and takes in her food by a mouth ſituated above it. Thus your naturaliſt was guilty of a miſtake, in declaring that Bees don't feed upon the duſt of ſtamina, becauſe the particles which compoſe them are larger, in diameter, than that of the hollow of the trunk; this is as if any one ſhould pretend to aſſert, that the elephant does not eat bread or hay, becauſe neither of them could paſs through his trunk. How was it poſſible for ſo able an enquirer as Swammerdam, to commit ſo groſs an error?

EUGEN. I cannot juſtify him, with regard to this article, but by cenſuring him upon another account; I mean, in confeſſing that he did not know the Bee had a mouth; he imagining that its only organ, for the paſſage of food, was its trunk. Thus he argued juſtly, according to his own notion; but then his notion was falſe. Since our diſcovery of the mouth I ſhow'd you; and ſince I myſelf ſaw that mouth in action, at a time when the trunk was motionleſs; you may believe, as a certain truth, that Bees ſwallow Plate IV. Fig. 2. Lett. D.

crude wax; and this, not only to convert it into true wax, but alſo to feed upon it. But this is not all. I'll ſhow you, that the quantity which they conſume of it, in order to ſupport themſelves, greatly exceeds that converted by them into wax, and vaſtly more than you could imagine; I mean, that they are prodigious eaters.

CLAR. You are going to inform me of ſome new prodigy, at which I ſhall no longer be aſtoniſhed.

EUGEN. In order to diſcover the whole extent of their wants, with regard to ſuſtenance, we ſhould calculate how many journies, (from an ordinary hive, one compoſed of eighteen thouſand Bees, for inſtance) theſe Bees would take into the fields every day, in order to bring crude wax from thence. The number of journies has given me that of the wax-balls or pellets; and the number of the pellets, that of their total weight; from whence ſubſtracting what is employ'd by them in making true wax, the remainder will give the quantity conſum'd, by way of food. I had diſcover'd, by preceeding experiments, that in a hive conſiſting of eighteen thouſand Bees, each of them took four or five journies every day; which makes about eighty-four thouſand journies, producing eighty-four thouſand balls of wax. I might have doubled, as you ſee, the number of balls, as each Bee brings two; but I choſe rather to take but the half, that I might not be reproach'd with amplifying. Weighing the wax-balls with accuracy,

I found

I found that eight of them weigh a grain. Dividing eighty-four thouſand by eight, the quotient gives the weight of the balls of crude wax brought during the whole day; and this amounts to ten thouſand five hundred grains. Now the pound weight is nine thouſand, two hundred and ſixteen grains; conſequently the quantity of crude wax made in a day, amounts to above a pound. There are ſeveral days in the year during which they make as great a harveſt; and they often are favour'd with fifteen or ſixteen together, either about the middle of May, or the beginning of June; in a word, the Bees, during ſuch days as are leaſt favourable, never fail to bring crude wax into the hive. As the Bees go forth for ſeven or eight months ſucceſſively, they muſt neceſſarily gather above an hundred pound weight of this ſubſtance, and perhaps much more. Nevertheleſs, if the wax is taken, at the year's end, from ſuch a hive as we are ſpeaking of, we perhaps ſhall not find two pounds weight of true wax in it. Hence it may be inferred, that Bees extract, from crude wax, but a ſmall quantity of true wax; that the greateſt part of that ſubſtance ſerves them as food; and that the reſt iſſues from their bodies, in the form of excrement.

CLAR. I had reſerv'd my admiration for the Bees; but I now divide it, in favour of the ingenious manner, wherewith you have calculated, the quantity of crude wax which a Bee eats in the compaſs of a year.

EUGEN.

EUGEN. Reſerve all your admiration for the ſubject on which we are going to diſcourſe. You will not have too much, in order to praiſe and magnify the author of ſo many wonders, as will be exhibited to your view by means of puny animals, by meer inſects; who will ſet before you works which the whole powers of the human underſtanding could never have thought of; and whoſe admirable ſtructure was not well diſcover'd, 'till the moſt ſublime and moſt tranſcendant geometry had been cloſely ſtudied and applied. What I here hint at, is the conſtruction of the cells. As we have found the origin of wax, let us proceed to the edifices in which they employ it, to theſe combs compos'd of cells. The firſt object which the Bees have in view, when all things are got ready for building their edifices, is to employ the wax; and the ſmall ſpot to which they confine themſelves, with all poſſible œconomy, and yet to make the moſt of it. We cannot deny but that this is their deſign; their every ſtep having that tendency, and the perfection of their work being nothing elſe. That we may be the better able to judge of the intelligence with which they carry on their work; let us firſt inquire what we ourſelves would have done, in caſe the author of nature, after creating Bees, had left to us the care of lodging them, agreably to the wants or neceſſities which we know them to have. We ſhall form a judgment, from the errors we ourſelves ſhould have fallen into, and which they do not

commit, of the excellence of their work. Don't loſe ſight, Clariſſa, of the three cardinal points following, on which the whole work ought to turn. I. To employ the ſmalleſt quantity of wax poſſible. II. To give, to the cells, the greateſt capacity or ſpace they can receive, on a determinate diameter. III. To employ the ſpot in ſuch a manner, that none of it may be loſt. The firſt idea fram'd by a man who was ignorant of geometry, who had never ſeen a hive, and was to prepare a habitation for Bees, would have been to make round tubes, and ſet them one upon the other. This is the form, in building, of many inſects, the preparation of whoſe materials coſts them no pains. But he who ſhould have begun his edifice with circular tubes, had miſtook in his firſt ſetting out; as he would have fail'd in one of the conditions, that of diſpoſing his ſpot to the beſt advantage. For you eaſily conceive that circular tubes, laid one againſt the other, do not touch in every part of their circumference; but leave conſiderable void ſpaces between them, all which are loſt. I'll trace before you upon the ſand, my ideas in proportion as I ſhall point them out to you. Suppoſe theſe circles to be the mouths of ſo many tubes; you ſee that there are ſeveral void ſpaces between each of them. This is the firſt error. As theſe tubes muſt be ſtopp'd at one end, and open at the other, our architect would not have fail'd to have laid a bottom of wax; and, of a number of theſe tubes

Plate XII. Fig. 1.

tubes, thus ſtopp'd and join'd together, he would have made a comb like that of the waſps; and ſuch a one as I now draw with my cane, where you ſee four tubes, each of which has a bottom turn'd the ſame way. Now this would be a ſecond error. The Bees would have taught him, that two combs, laid back to back, form but one; conſequently, that a ſingle bottom is ſufficient for two cells, the one of which is on one ſide, and the other on the other; which I prove in manner following. This figure exhibits to you four tubes, each pair of which has a common bottom. The architect above-mentioned would doubtleſs have made the bottoms flat, to expend leſs wax, like thoſe here drawn by me. But this would have been a third error. We muſt ſend him to ſchool to the Bees, and there he will learn, that pyramidal bottoms, ſuch as thoſe of the ſix cells which I here trace, are form'd with a leſs quantity of wax than flat bottoms. How many other errors would he have committed, which the Bees avoid with ſurprizing ſkill, as you ſhall ſee preſently? Let me ſet before you this piece of comb, and argue upon the objects as they lie before us. 'Tis neceſſary, as you proceed, that their cells lie all contiguous one to the other, without leaving the leaſt void ſpace between them. It muſt be confeſs'd that triangles and ſquares, ſuch as theſe, would have produc'd the ſame effect. But as the triangle and ſquare have a leſs area than a circle, whoſe diameter is the ſame; the Bee, by this means, would have had

Plate XII. Fig. 2. Letters A B C D.

Ibid. Fig. 3. Lett. A A.

Plate XII. Fig. 4.

Plate IX. Fig. 2.

Plate XII. Fig. 5.

Ib. Fig. 1. Lett. A B.

leſs

leſs ſpace for lodging commodiouſly; and a ſecond fault would be, more wax muſt have been conſum'd. Such a figure muſt therefore be made choice of, which, under the ſame circumference, would be more extenſive or capacious than the triangle and the ſquare, and employ a leſs quantity of wax. I am certain that the Bee did not take up the rule and compaſs to find out this figure; but man was forced to have recourſe to thoſe inſtruments, in order to inform himſelf of what they know ſoon after their exiſtence, *viz.* that among the ſeveral polygons, from the triangle to the circle; the hexagon, or figure with ſix ſides, is the laſt of all, of which we may aſſemble together as many as we think proper; all whoſe faces will join; which will leave no void ſpace between them; and will be more capacious than figures, the number of whoſe ſides will be fewer. Now this is the figure choſen by the Bee, who thereby has anſwered every end. I. The oeconomy of the wax, ſince the circumference of one cell ſerves to the circumference of thoſe contiguous to it. II. The oeconomy of the ſpot; ſince theſe cells, which join one to another, leave no void between them. III. The greateſt capacity or ſpace poſſible; ſince, of all the figures which may be contiguous, or lie cloſe one to the other, that with ſix ſides gives the largeſt area.

CLAR. I comprehend all this perfectly, and that without the leaſt aid of geometry or a problem.

EUGEN.

EUGEN. This is not the moſt difficult taſk, but we ſhall come to it by and by. 'Tis very proper that theſe tubes be clos'd at one end. 'Tis neceſſary for the Bees that this ſhould be, not by flat bottoms, but by pyramidal hollows. Tho' you now have cells before you; tho' by breaking them, you may ſee every part of their inſide; you yet would not eaſily diſcover the whole ſcience and induſtry employ'd in their conſtruction; if I did not accompany them with ſome explications, the reſult of my reading, experience, and long obſervations. But, for this purpoſe, it will be neceſſary that you accuſtom your ſelf a little to the ſtile of geometry, which I will adapt, to the beſt of my power, to your underſtanding.

CLAR. I muſt deſire you not to employ the terms of that ſcience, for theſe would certainly give me the head-ach. Do as well as you can: for I am reſolved to liſten to none but common terms, to ſuch demonſtrations as ſuit the capacities of children.

EUGEN. I muſt obey your commands; and ſince you require it, we'll build together ſome card-houſes which will have a vaſtly pretty effect. A circumſtance which makes us eaſy is, that ſhould any one come and catch us unawares, you'll have no juſt cauſe to reproach me, ſince I was forced to it. Let us firſt cut this card into three equal parts.

Plate VII. Fig. 1.

CLAR. What are you going to make?

EUGEN.

EUGEN. A card-cell; ſuch a one as I ſhould make for your little daughter.

CLAR. Mighty well. Proceed in your play.

EUGEN. Let us fold one of theſe three pieces into two, doing this lengthwiſe. Afterwards cut one of the ends of this folded piece ſlantwiſe. Unfold it. You ſee that it terminates in a pyramid; and that the fold made by us forms a kind of ſtay, which divides this piece into two equal ſpaces. Take notice of this fold, as it will be of ſervice to us afterwards. Let us fold and cut, in the ſame manner, the other two pieces of the ſame card. Let us open them, but not entirely; in order that the fold, which I term the ſtay, may ſeem to form two pieces of one only. Let us next ſet theſe three pieces upright, cloſe one to the other. Now bring them together, in a kind of circular form, as tho' we were deſirous to make a tube of them. Each of theſe three pieces being divided into two, by its fold; 'tis plain that our tube conſiſts of ſix planes, all which together form a hexagon, or figure with ſix ſides. Thus we have a Bee-cell, from its opening (downward) to the part where its pyramidal bottom muſt begin. Theſe three pieces joined together in form of a tube, terminate by three triangular points, leaving three void ſpaces between them. Now, in what manner will the Bee fill up theſe vacuities; and terminate at the ſame time her cell by a ſingle point, or ſort of capital in a pyramidal form alſo?

Fig. 2. Fig. 3. Fig. 4. Lett. A.

Fig. 5. Lett. E. f. G. Fig. 6.

Fig. 5 & 6. Lett. a.

Fig. 6. Lett. B. Fig. 6. Lett. C.

Fig. 6. Lett. E. f. G.

alſo? This the Bee has taught me, and I'll now repreſent it to you by cards. You know, or may know, that two triangles join'd, baſe againſt baſe, form what is call'd a lozenge. The three void ſpaces can be fill'd only by three triangles reverſed; the cell muſt be terminated by a hollow pyramidal bottom, with three faces, compos'd of three triangular plates, whoſe baſes ſhall lie on the baſes of the revers'd triangles. You therefore muſt form ſix triangles, the three lower ones of which will ſerve to fill up the void ſpaces; and the three upper ones to form the capital or pyramidal bottom. But to ſave ourſelves trouble, inſtead of ſix triangles, let us make three lozenges with our cards, in like manner as the Bee does with wax, and the ſame effect will be produced.

Plate VIII Fig. 7. Lett. a, b. Fig. 9. Lett. E, f, G.

'Tis thus you perceive they give us the ſix triangles deſired, three right and three revers'd, all which nevertheleſs form but three pieces. The lower triangular part of each lozenge, fills exactly one of the triangular voids of the tube; and the upper triangular part of the ſame lozenges, when join'd by their points, make that hollow pyramid which forms the bottom or capital of the cell. Let fall this little capital, compos'd of three lozenges, and you'll find that the three lower parts of the three lozenges, will go and fix in the voids of the tube, and fill them exactly. Thus you have a very rude figure of a Bee's cell.

Fig. 9. Lett. P. P. P. Lett. mm, mm, mm. Fig. 8 & 9. Lett. P. Ibid. Lett. P. Fig. 9. Lett P P P

CLAR. How obſtinate was you, in being abſolutely reſolv'd to ſplit my head with your horrid

horrid terms, tho' you had ſo plain and ſimple a way of expreſſing your meaning. I underſtand you ſo perfectly, that, ſhould the Bees forget the art of making cells, I am able to inſtruct them in that particular. I could let them into the whole affair at once, with only a couple of cards and a pair of ſciſſars.

EUGEN. Come, don't be quite ſo much elevated with your proficiency. I have acquainted you with the mechanical conſtruction of cells; but then, can you account for their mechaniſm? anſwer me this point.

CLAR. You ſtop me at once. Here, bring ſome cards. Come, here are ſciſſars: cut away, and let me know the mechaniſm you are ſpeaking of.

EUGEN. I am delighted with your ſprightlineſs. Inſtruments are made to deſcribe figures; but to diſplay the reaſons of figures, we muſt have recourſe, not to inſtruments or tools, but to ſomething elſe. Thoughts are expreſs'd by words only.

CLAR. Well, let me have words then. Inform me of theſe reaſons.

EUGEN. Obſerve that theſe lozenges have two angles more open than thoſe of a perfect ſquare; and that two are ſharper or more acute. The Bees always make the two large angles of 110 degrees, and the two ſmall ones of 70. Plate VIII Fig. 9. Lett. P P P

CLAR. I am afraid that there is geometry in this; however, I will allow you this deſcrip- Plate VIII Fig. 9.

tion, as I know the meaning of one angle being more open than another.

EUGEN. The Bees deviate as little as they can from this rule, conformably to which they ſhape their lozenges.

CLAR. This is wonderful. But I don't yet ſee the reaſon why they prefer this figure or ſhape.

EUGEN. 'Tis purpoſely to be as ſparing as they can of wax.

CLAR. Strange! what can lozenges, cut in one ſhape rather than another, have to do with the ſaving of wax?

EUGEN. This is the mighty difficulty, which I'll explain to you as well as I can. In comparing tranſiently, a flat-bottom'd cell, with another whoſe bottom is pyramidal, we don't perceive (and even wou'd not believe) that of all kinds of cells, the flatt-bottom'd one takes up the greateſt quantity of wax. It is yet demonſtrated, and that too by geometry, that the Bees huſband their wax, by making pyramidal bottoms. 'Twas enough that the Bees had diſcover'd this wonderful property, which, poſſibly, would otherwiſe have never been found out by man: the former have nevertheleſs extended their geometrical views farther. A choice might be made, among pyramidal bottoms, in order to find out ſuch as would take up the leaſt wax; and this the Bees have done. They diſcover'd that among the ſeveral cells of the ſame extent, and with a pyramidal bottom; the cell which can be form'd with

with the leaſt wax, is that, each of whoſe lozenges has two oppoſite angles of 110 degrees, and the other two angles of 70.

CLAR. You'll make me run mad with your angles, your degrees, and your pyramidal bottoms. Would you perſuade me, that views of oeconomy prompted our anceſtors to wear high-crown'd hats; and that thoſe ſugar-loaves took up leſs cloth, than the flat hats now worn by men?

EUGEN. I would gladly make you underſtand, without angering you, one thing which is certainly true; I mean, that a ſteeple-crown hat, rais'd purſuant to the rules taught us by the Bees, would take up leſs cloth than ſuch a one as was flat, and in the ſhape we wear them. This is prov'd in manner following. But we muſt firſt ſet out with a theorem, which will lead us to a problem.

CLAR. You ſay right: we muſt ſet out, but 'tis from hence; for I find you are now poſſeſs'd by the dæmon of geometry. To lay him, let us change our ſubject, and ſet out homewards. As we walk along, I'll get you to clear up the following difficulty. How can ſuch cells as are pyramidal, fix in with the cells oppoſite to them, and which are pyramidal likewiſe? In caſe they meet at their point, their bottoms are no longer common; conſequently no wax would be ſaved in this reſpect; there even muſt be large void ſpaces left, which ſhows that the ſpot or ſpace is not laid out to the beſt advantage.

EUGEN. You would certainly be in the right, was this really the caſe; but you ſhould ſuppoſe, from the whole work of the Bees hitherto; that they foreſaw this inconveniency, and provided a remedy for it. Their conduct on this occaſion is the more ingenious, as 'tis the more ſimple. The ſmall pyramids which terminate all the cells on one ſide or face, enter into that of the oppoſite face; ſo that the three lozenges which form the bottom of a cell of one of the faces, are, at the ſame time, (and each ſeperately) one of the lozenges of three cells laid one againſt the other. As the partitions by this means are common, a great deal of wax is ſaved, and no room is loſt. Take this comb; ſtick a pin into each of the lozenges which forms the
Plate VIII Fig. 10. bottom of a cell. Now ſee, by the oppoſite face, where the points of our three pins meet.

Fig. 11. CLAR. They all three, indeed, have entered three different cells. I will not deny, Eugenio, but that I am ſtruck with wonder, at the ſight of this admirable work. I'm quite amaz'd and confounded, to find that ſuch little animals, ſuch contemptible inſects ſhould execute works, which, for beauty, elegance, and regularity, equal the attempts of the moſt enlightned human reaſon; of ſuch reaſon as has been moſt exercis'd in ſublime ſciences. I ſcarce know how to reconcile theſe deep views with that ſort of mechanical reaſon, by which faculty alone (as I imagine) brutes are guided.

EUGEN.

EUGEN. I don't see why this should disorder, in any manner, your system. The Being who taught the new-born child to make a pump of his mouth, therewith to draw forth his nurse's milk, at the same time that this child is utterly ignorant of pneumaticks, has taught the Bee to make a cell without the assistance of geometry. 'Tis in the perfection itself of the Bee's structure, that I draw a strong argument, in opposition to the comparison which some would form, between our reason and that of brutes. What is human reason? 'Tis a faculty weak at first, but which afterwards displays itself by insensible degrees, and acquires lights or knowledge: it improves more or less by labour, and according to the use that is made of it: this faculty comes into the world ignorant, and stands in need of instruction; and accordingly 'tis instructed. The brute, on the contrary, is born as perfect as it can be; it knows every thing needful for it to be acquainted with; at its coming into the world, it issues from the hands of its creator compleatly fashion'd, in like manner as a tool or instrument out of the hands of a workman. The Bee, of a day old, is as perfect a geometrician as the Bee of a year. This difference between our reason, and the reason or instinct of animals or brutes (call it which you will) is enough to show that one is not the other; that each of them act upon different principles; that both of them are mysteries in nature, and that we must not expect to find out that of brutes, till we have first dis-

cover'd our own; or that the beſt courſe would be, agreeably to our determination the other day, to worſhip, in awful ſilence, the ſecrets of the Almighty.

CLAR. Your Reflection is exceedingly juſt. Let us ſeperate with this moral, and we ſhall take with us the uſeful join'd with the profitable. I deſire you to meet me to morrow, in order to diſcourſe on ſome other ſubject. Tell me what it ſhall be?

EUGEN. We ſhall proceed with the cells, this being a topic not yet exhauſted. You have taken a view of the deep knowledge, and the aſtoniſhing induſtry of our little artificers. But you don't know that they go ſtill further; they committing miſtakes, and afterwards correcting themſelves; they meeting with obſtacles, and ſurmounting them. You did not obſerve, that thriftineſs, with regard to wax, engages them to make the walls or partitions, and bottoms of their cells ſo very thin, that one would ſcarce imagine thoſe diminutive edifices were ſtrong enough to ſupport the weight of their bodies, their perpetual motions, and their heaps of honey; if we did not know that they, upon occaſion, are able to prop and ſtrengthen them. You have not ſeen them repair, improve, and give the finiſhing ſtroke to their habitations. We are ſtill to examine the ſeveral dimenſions of the cells, and the frame of the combs; and no mention has been yet made of the royal cells. Hence you may judge, that we ſhall have topics enough to diſcourſe upon.

CON-

CONVERSATION XII.

Continuation of the cells. Errors committed by the Bees in building them, and how they add the finiſhing ſtroke. Dimenſions of a cell. Combs of a royal cell.

EUGENIO.

YOU ſeem in deep meditation, Clariſſa. Perhaps you may not be recovered from the ſurprize, into which the prodigious knowledge of our inſects threw you.

CLAR. I don't deſign to recover from it, this tending directly to make me acknowledge the preſence of a Creator; a ſight that is always precious to me, and which I am ever glad to have repeated. But our Bees have given me an opportunity of making reflexions I was revolving, and which I muſt communicate to you. Ever ſince we parted, I have not been able to get theſe cells out of my head; and I cannot forbear ſtill admiring ſo perfect a Work. I have been ever ſince figuring to my fancy, a Bee, handling its materials in the ſame manner as an artificer would do; cutting lozenges under certain determined angles; and diſcovering the utmoſt thriftineſs with regard to the diſpoſal of the wax. As I imagined to myſelf this inſect buſied in its work; purſuing its ends with certainty, and this by the

beſt means; I was perpetually tempted to allow them judgment or reaſon; and even a ſeries of argumentations, ſuch as are neceſſary for man; and ſuch as few of the learned, among you, are capable of boaſting. In the extaſy to which this raiſed me, I was aſham'd to ſee myſelf obliged to yield, in the article of underſtanding, to inſects. But, how, is it poſſible for us to reſiſt the temptation of ſyſtems, eſpecially when it concerns our honour. I muſt give way to this alſo, as it will neceſſarily turn to the glory of the Almighty. The recalling to my memory the compariſon with regard to the muſicians, has been of advantage to me. I am thoroughly pleaſed with it; and I thereby very well conceive, how it is poſſible for an animal, though uninformed by reaſon, to act as if ſhe were indued with that faculty, and even the moſt ſublime kind of it. It frequently happens to me, whilſt I am ſitting by my Harpſichord, to play on it, without once reflecting on what I am doing. I will play, whenever you pleaſe, *Couperin*'s *Paſtorals* or *Bees* * ; and talk with you upon any ſubject at the ſame time. On this occaſion, my fingers only ſhall play. I ſhall be quite abſent in thought with regard to the muſick: my mind, the reaſoning faculty, and even the will, will have as little ſhare in it, and all theſe ſhall be employ'd in entertaining you. My fingers

* *Les Bergeries* ou les *Abeilles de Couperin.* Theſe are pieces of muſick.

once

once ſet agoing, ſhall perform of themſelves a work almoſt equal to a cell; and execute the whole quite mechanically. I then will boaſt my having form'd *automaton*-fingers; fingers which play a harpſicord-air, without my being concern'd with, or my reaſoning faculty having any thing to do with them. Now, why ſhould we imagine the Almighty has not the ſame power; I mean that of creating animals capable of executing, without the faculty of reaſon, ſuch works as are the moſt complicated, and require the greateſt induſtry?

EUGEN. I am overjoy'd at my having given you ſo fair an opportunity, for arguing thus juſtly. You have ſet my compariſon in the moſt ſublime light; 'twould, therefore, be a pity that I ſhould weaken it, by thoſe particulars which I am to obſerve to you farther. Nevertheleſs, happen what will, I muſt ſee whether we can carry it on to the end. Let us proceed with the Bee, quite to the concluſion of her work. How accurate, how geometrical ſoever we find the Bees, yet their cells with ſix faces are not always form'd quite free from errors. It frequently happens that, in the ſame cell, ſeveral of theſe faces or ſides ſhall be wider than the reſt; and, a ſingular circumſtance is, theſe irregularities are ever more conſiderable towards the bottom, than about the opening. Of this the Bee herſelf ſeems to be ſenſible; and endeavours to correct all her miſtakes, in proportion as her work advances forward. The irregula-

rity of the faces occaſions ſome in the lozenges, which are not always made as regular as they ought to be. We ſhould not be ſurprized, were the ſkill of our artificers to fall ſhort, in a Work of ſo much delicacy; but we may juſtly be ſo, to ſee Bees commit errors on this occaſion.

CLAR. Why ſo? To go on with your compariſon; I ought to be no more ſurprized on this occaſion, than if my fingers, after being taught to play a harpſicord-air without me, ſhould yet miſtake in ſome note.

EUGEN. True. But would not your wonder increaſe, if thoſe very fingers, after miſtaking, ſhould correct themſelves; and if, after ſtriking a falſe note, they ſhould correct themſelves by ſubſtituting a third or a fifth; or by ſome other note, which ſhould complete the harmony; and this without the aid of your will, or your having the leaſt knowledge of it?

CLAR. I don't think this poſſible.

EUGEN. And yet this is what the Bees do. Whenever the inequalities become too conſiderable in one cell, either by their own fault, or by ſome circumſtance out of their power; they are able to correct them, by adding to, or leſſening the next cell. Thus theſe irregularities don't increaſe. If a pyramidal bottom, for inſtance, is too much extended; they leave a ſmall portion in the pyramidal bottom of the next; and the contrary in the oppoſite caſe. They are guilty of ſuch miſtakes as may appear of much greater conſequence. We ſometimes meet with

pyramidal bottoms, which, inſtead of being compoſed of three lozenges, conformably to the rule, conſiſt of four pieces; and of theſe four pieces, two only will have four ſides; and the three others ſhall be compoſed of more or leſs. Hence it appears that our Bees may fall into errors; they may fail in giving, to the firſt lozenge, its ſuitable dimenſions and angles; but then they know how to remedy their miſtakes; they then fix more pieces together, in order that the pyramid, may aſſume ſuch a form or figure, as may be as little different as poſſible from that which it ought to have. But this is not all; they ſuiting themſelves to times and places. Whenever they are forced, by the inclination of the partitions of the hives, or from ſome other cauſe, to deviate from the right line; they ſubmit to this neceſſity by giving to their little tubes, or, to ſpeak more clearly, the cavity of their cells, a proportionate curve: and thence it is, that we ſometimes meet with cells which ſeem in the form of a crooked tube. Reconcile this now, if you can, with the compariſon which gives you ſo much delight. See whether the *automaton* is maſter of retroſpection; or can turn back, at proper ſeaſons, to correct ſuch miſtakes as it may have fallen into.

CLAR. I don't diſcover any impoſſibility in this; and thus I conceive it. I have accuſtom'd my fingers; have taught and diſpoſed them to proceed without a guide; to execute, ſingly, with the greateſt exactneſs, certain regular and complicated

plicated motions. When once ſet to work, I attend to them no longer; I let them go on, without any direction but their own; and accordingly they proceed forward, without deviating from their firſt Impreſſion. I own, indeed, that they may depart from it; that this happens frequently; and that whenever they do deviate, all is over; they are bewilder'd, and unable to recover themſelves. But it is enough that this does not happen to them always, for us to ſay that we are able to form *automatons*, which indeed are not ſo perfect as the Bee. But what are we, to compare our weak powers with the Supreme Being! Muſt we infer, becauſe we are not able to make better, that the author of nature cannot form *automatons* of a much more perfect kind than ours?

EUGEN. This philoſophical argument deſerves thanks, at leaſt, from me; ſince it tends to defend a compariſon which eſcaped me. We are now fallen on a ſubject that has already been well canvas'd; and concerning which, it would be difficult for us to offer any argument, *pro* or *con*, that has not been alledged before. 'Tis my opinion that we had better return to our Bee-cells; and this I will now do. As the gathering and preparing of wax coſt the Bees much pains, it is incumbent on them to be extremely careful of it; and we have ſeen how ſkilful they are in that particular. I will make you alſo obſerve, that this thriftineſs prompts them to make the partitions of their thin cells, ſo as that the

ſolidity

ſolidity in their conſtruction may ſupply for the defect of materials. No paper is ſo thin as the ſide and bottom-pieces of their cells. Nevertheleſs, theſe cells ought to be ſtrong enough to reſiſt the ſeveral motions of the Bees who go in and out of them continually. The parts moſt liable to injury, are the entrance to the cells; theſe being the moſt ſtrongly and moſt frequently attacked. Accordingly the Bees take care to ſtrengthen them; they adding, quite round the circumference of the apertures, a ſtring or fillet of wax; by which means this mouth is three or four times thicker than it would otherwiſe be, was it no thicker than the ſides or faces. We even perceive this fillet about ſuch cells as are but juſt begun; it is thicker in the angles than elſewhere; for which reaſon the opening of the cell is not a perfect hexagon. The building of a cell is not the work, merely of a moment, with regard to the little artificer. How dexterous and ſkilful ſoever ſhe may be; tho' ever ſo diligent and active in her toil; it is only by time and the greateſt pains, that ſhe is able to raiſe the partitions of her cell, and reduce them to a proper thinneſs. She does not caſt them in a mould. If a Bee, in building a cell, ſhould form it (at firſt) as thin as it is neceſſary for it to be, ſhe would do wrong. This part, being too weak to reſiſt the weight and motions of the inſect, would burſt; and accordingly ſhe gives it much more ſolidity and ſtrength, than is requiſite; the Bee afterwards leſſening and paring it away,

away, as may be found neceſſary. This part (I mean the paring away) is left to other Bees, whoſe buſineſs it is to poliſh, as it were; to repair and compleat all that is ſtill rough, and give it the finiſhing ſtroke. This is the employment of the greateſt part of our little labourers in wax. There is no difficulty in getting a ſight of them when thus buſied; as it is their daily, and almoſt hourly, exerciſe.

CLAR. If this be ſo eaſy, let me diſcover it myſelf. Permit me to have this pleaſure, and to inſtruct you in what you know much better than I. Let us ſtoop to the hive. Both of us will make obſervations, but I only will ſpeak. It will not be juſt that you ſhould have all the trouble. I will now inform you in what manner the Bees repair their cells. Methinks I perceive one planing or ſcraping. I am not yet well enough verſed in their art, to uſe the proper Term. She works, very fortunately for me, at the entrance of her cell; and I plainly ſee all her operations. She moves her teeth with prodigious ſwiftneſs, and ſcrapes the partitions. She now takes away ſome minute fragments of wax, which look like ſo many chips or ſhavings. My joyner is not more expert. Theſe fragments ſhe joins, and works them up into a ball. I really ſee one as big as a pin's head. The Bee flies away, and takes this ball with her. However, the work does not ſtand ſtill. Her place is inſtantly ſupplied by another, who advances in farther; probably to work at the bottom. I judge, from her

her motions, that ſhe is exerciſed in the like operation. My conjecture was right; ſhe going away, like the former, with her little ball of wax.

EUGEN. You have made very good obſervations, Clariſſa, and been eye-witneſs to the manner in which the Bees repair their cells. We will now proceed to other particulars. Would you willingly know, with little trouble to yourſelf, how many cells there are in a comb? This may be very eaſily found. Let us make uſe of the comb now lying before us. We will only count the firſt range of cells. There are twenty, as you perceive, on a line. Let us meaſure this line. It is four inches long. Our comb is fifteen inches in length, and ten inches broad. All the cells that ever were, or ever will be made, are two lines * $\frac{2}{3}$ in diameter. Theſe ſeveral quantities being known, you will find, by a ſingle rule in multiplication, that there are nine thouſand cells on the ſurface of this comb. I ſpeak only of the cells of the working Bees; for thoſe of the drones being larger, and their diameter of three lines $\frac{1}{3}$; twenty of theſe would cover a line of five inches, and ſix lines in length, and a little more.

CLAR. You declare then, that the diameter of all cells ever made, or that will be made, were and will be, two lines $\frac{2}{3}$ in diameter.

* *A Line* is a French meaſure, $\frac{1}{12}$ of an inch.

EUGEN.

EUGEN. I do affirm this. But what inference would you draw from thence?

CLAR. You'll say I am out of my senses. But be that as it will; I must tell you the crotchet that is come into my head. It has been wished, and will doubtless be long so, that men would invent one language which might be common to all the nations of our earth. I have read somewhere, that a certain philosopher had attempted to make one; but, in all probability, this was endeavoured without success, since we hear no more of it, for which I am very sorry. I too am fired with the ambition of making my name famous, by an invention of the like kind. What think you of a person who should have discovered a measure which might be known to all the nations of the world, and proper for all ages; that men might have, in all places, a model made by the hand of nature; and, on which, every person might verify and compare the measure used by himself, and apply to it all the rest used in the world? Would not this be a fine secret?

EUGEN. An excellent one.

CLAR. And this I have discovered. 'Tis the dimensions of a cell. 'Tis a certain fact that all Bees which ever existed, from the creation of the world to this day, have built cells of the same size and diameter; and will proceed in this manner till time is no more. I believe it is equally true that, from Peru to Japan, all the cells of Bees are raised upon the same laws, and with the same measures. Consequently; was I

to

to inform a Japoneze, by writing, that a certain thing I ſent him was four inches in length, he would not underſtand me; but ſhould I obſerve that its length was equal to that of twenty Bee-cells, he would underſtand me perfectly; as likewiſe would the Peruvian, the Muſcovite, &c. All theſe would inſtantly form to themſelves an idea of a length, the ſame as what we underſtand, when we ſay four inches. Thus we have a meaſure that is invariable; known to all nations, and found every where. In a word, 'tis an univerſal language with reſpect to meaſure, and will be underſtood till the end of time.

EUGEN. The farther we proceed in our conferences, the more I perceive your philoſophic genius opens, ſtrengthens and increaſes; or rather, you diſcover talents which your modeſty had hitherto concealed. Is it poſſible that I ſhould have found the art (if a figure of Socrates will be allowed me) of being the midwife of your thoughts? The philoſopher who formed to himſelf the ſecret of an univerſal language was Mr. Leibnitz *, one of the moſt extenſive and moſt ſublime genius's that Germany ever gave birth to. He uſed to ſay, ſpeaking of this invention, that he was forming an alphabet of human thoughts. This great man, whoſe only view was the public utility, would have obliged all the inhabitants of our earth to uſe one and the

* This had been attempted before by our biſhop Wilkins, and by Algarme: But Mr. Leibnitz did not approve of their method, and had formed to himſelf one quite different.

ſame language; and reduced Europe, with reſpect to temporals, under a ſingle power; and under one ſole head or chief with regard to ſpirituals. Being a German, you will not be ſurprized to hear that he gave the government of Europe to the emperor; but you will be more ſo, when I inform you that Leibnitz, though a Lutheran, aſcribed the church-ſupremacy to the pope: "So greatly, (ſays the illuſtrious hiſtorian of his life) "did the ſyſtematic ſpirit, which he poſſeſſed in a ſupreme degree, prevail, in religious matters, over party ſpirit." But all theſe fine projects remain ſtill unexecuted; the reaſon of which, (according to the ſame hiſtorian) "is that different nations agree only in not "underſtanding their common intereſts." I am afraid the like fate will attend your ſecret, with reſpect to which I am ſorry to obſerve, that you did not hit upon it firſt; Mr. Thevenot, his majeſty's librarian, having ſtarted it before.

l'Hiſt. de l'Acad. des Sciences, in 1716.

CLAR. I wiſh that Mr. Thevenot had been far enough. What did he mean to thus anticipate me in an invention which, otherwiſe, would have immortalized me?

EUGEN. The antients have played us many ſuch tricks. But however this be, you'll be no great loſer by it. This diſcovery has had no better ſucceſs than that of Mr. Leibnitz. Let us go on with examining the other dimenſions of the cells. Their depths are not ſo certainly fixed as their diameters. The cells of the Working-bees are commonly five lines and a half in depth;

and ſuch of the worms and maggots as turn to drones, eight lines, and ſometimes leſs. When theſe cells are not neceſſary for bringing up worms, they turn them into ſtore-houſes for the honey. But ſome are appointed for this uſe only, and theſe are deeper than the others. I have ſeen ſome that were ſix lines in length. Whenever the proviſion of honey is ſo great, that the Bees can ſcarce get veſſels enough to lodge it in; when theſe find it difficult to build a ſufficient number of cells to contain all the honey made by them; they then either lengthen the old ones, or make the new ones longer than thoſe built by them before. Hence it is that the ſurfaces of the combs are never equal; and ſome parts of them are raiſed higher than the reſt, and bunch out. Methinks I have obſerved to you all that can be ſaid, with regard to the cells of which combs are formed. Let us now conſider the combs themſelves.

CLAR. But pray now, what is become of your royal palace? What idea ſhould we form to ourſelves of a traveller, who, deſcribing a city, ſhould give an exact plan of all the common houſes and hotels, and forget to mention the Louvre?

EUGEN. Your reproach is very juſt: nevertheleſs, this omiſſion was not owing to forgetfulneſs in me; but from my opinion, that this ſubject will be more proper, after we ſhall have gone through what I have to ſay with regard to combs. The diſpoſition of theſe, as well as that

of the cells, offers ſuch particulars as do honour to the underſtanding of Bees. When theſe noble inſects are once ſettled in a hive that pleaſes them; 'tis not long before they lay the foundations of a comb, which they lengthen and widen with ſurprizing ſwiftneſs. But the Bees, before they give it the whole intended extent, divide or ſeparate themſelves: part of the workmen begin a ſecond; and ſometimes another party undertake a third. When there are two or three work-ſhops, a greater number of artificers may labour together, without hindring one another; and they have an opportunity of doing more buſineſs in a ſhorter time. Having a glaſs-hive here, which gives us a view of its inſide, 'twere almoſt needleſs to tell you that theſe combs lie parallel one to the other; and that there is left between every one of them, a ſpace which ſerves as a ſtreet; broad enough for two Bees to paſs by together. Obſerve, on the ſurface of the combs before you, holes which go quite through it.

Plate IX. Fig. 2. Lett. a,a,a.

CLAR. Let me gueſs for what uſe theſe holes are deſign'd. I imagine them to be narrow ſtreets; croſs-ways or lanes made by the Bees, in order to paſs from one comb to another, without being obliged to go a round-about way.

EUGEN. This is not mere gueſs, for you have hit upon the very thing.

CLAR. I muſt ſtop here a moment or two, and contemplate our hive: My love for obſervations increaſes greatly. What numberleſs multitudes are here! our moſt-frequented markets are not more

more crowded with people than the ſtreets of a hive. We are not tired with gazing upon this ſight. How great an activity, what diligence, what love of labour do I behold! 'Tis with infinite pleaſure I recall to my memory all you have obſerved to me on this ſubject. A hive is a city, the inhabitants of which don't dwell in their houſes. They neglect their own conveniencies, for the ſake of the public weal. If they build, 'tis only to hoard their common proviſions, and to bring up their young; they contenting themſelves with lodging in the ſtreets, and the places of public reſort. Another obſervation made, as I ſurvey our combs, edge-ways is, I perceive an irregularity which diſpleaſes me a little. Can it be peculiar to this hive, or is it common to all? A regular paralleliſm is not obſerved between theſe ſeveral combs. I don't know whether you take notice, that I begin to ſpeak the language of geometry. However, as I might miſtake, in thus talking in a learned ſtrain, I will explain myſelf. By this term regular parelleliſm, my meaning is, that theſe combs are too far diſtant one from the other at top, and that they don't fall perpendicular; they having left a void ſpace, which the Bees found it neceſſary to fill up with an after-comb. Plate X. Fig. 1. Ibid. Lett. A.

EUGEN. The term parelleliſm is very juſt on this occaſion; and your obſervation is a new proof that Bees may commit miſtakes, and are able to rectify them. Theſe inſects, whenever they begin their combs, form, at the top of

the hive, a ſort of hand or foot, that ſerves as a tie or ſtay to the whole edifice, which is to hang from it. The Bees, at the ſame time that they lay the foundations of the firſt comb, prepare likewiſe thoſe of the ſecond. The latter muſt be uſually placed at ſuch a diſtance from the former, that both of them falling parallel, no more ſpace muſt be left between them, than what is ſufficient for two Bees to paſs. Nevertheleſs, they ſometimes happen to miſtake, and the ſecond comb is too far diſtant from the firſt. In order to recover part of the too great void ſpace ariſing from this bad poſition, the Bees carry it on obliquely; and give it, in proportion as they carry it on, an inclination tending toward the other. Sometimes the void is ſo conſiderable, that the Bees cannot bear with it. They then build a third between theſe, whoſe extent is no larger than juſt to fill up the too great void: they terminate it in that part where the two others leave, between them, ſuch an interval only as may be proper; like to that which gives us occaſion to make this remark.

Plate X. Fig. 1. Lett. A.

CLAR. I return to the foundation of theſe edifices which are at top. I am not ſurprized that theſe combs ſhould be liable to fall. Whenever this happens, 'tis as if the whole diſtrict of a city was to be overturned in an inſtant. This muſt be a ſort of dreadful earthquake with reſpect to theſe poor little inſects.

EUGEN.

EUGEN. This calamity, indeed, happens but too frequently; on which occaſions, a multitude of innocent, diminutive creatures among them, are killed, in their cradle, as it were. However, the Bees do all that lies in their power to prevent theſe cataſtrophes. Though the cells are formed of exceſſively thin wax-leaves, yet the combs grow heavy when very full of honey. Their own weight is ſtrong enough to break the ſtays or ties by which they are ſuſpended from the top of the hive. But our artificers have other methods to fix them; they multiplying the ſtays wherever they have an opportunity to do this. You here have a proof of what I now obſerve. Theſe ſmall bodies of wax, one end of which ſticks to the pane of glaſs, and the other to the comb, are ſtays or ties. There are others of the ſame kind on the oppoſite ſide of the comb, to fix it to the next; and by this contrivance they are all bound one to the other. Thoſe who prepare hives for lodging of Bees, ſet up (croſswiſe) in them ſmall ſticks, which afterwards ſerve as props; prevent them from falling, and ſave the Bees a great deal of labour. But 'tis time that we proceed to the royal cells, to the palaces of the queens, a deſcription of which I promiſed you. I'll firſt ſhow you one, and afterwards argue upon it. D'ye ſee this? Plate IX. Fig. 3, 4. Lett. A A. a a.

CLAR. How! Is this the thing which you term a queen's palace? I ſhould rather call it a miſhapen lump of wax. Upon my credit, if the

Bees cut us out work, and puzzle us in geometry; we are even with them, as to architecture.

EUGEN. We are not very ſure of this. I would not venture to cenſure, ſo haſtily, the figure or draught of this cell.

CLAR. You may, if you think proper, conſider it, as elegant, light, and well wrought; but I imagine you will not attempt to prove, that there is any thing in it which can be called deſigning.

EUGEN. As we have ſomething elſe to do, I ſhall ſay but a word or two upon this queſtion. Geometry is a ſcience founded on clear and diſtinct truths; or ſuch as do not leave us the liberty of doubting. Now architecture is a ſcience, the principles of which have no other fundamental rules than taſte, which has none. Should you aſk me what taſte is; the only definition I can give you of it is, that 'tis a *je ne ſçai quoi*; a certain ſomething, which pleaſes I know not how. The Chineſe, who agree with us in geometrical truths, differ from us with reſpect to the rules of architecture. They are not tempted to alter theirs for ours; and poſſibly we may be the people to make the exchange, their drawings pleaſing us already. To you the palace of a Queen-bee ſeems rude, and mean; but, did you ſee with her eyes, it doubtleſs would appear to you ſpacious, grand, commodious, and worthy of her majeſty. Let us therefore deſcribe this edifice, without criticizing upon it. The Bees depart from their uſual

ſtyle

ſtyle of building, when they are to raiſe cells, for the bringing up of ſuch worms as will become Queen-bees. Theſe are not hexagonal cells, but, as you ſee, in a roundiſh oblong form; having one end bigger than the other, with their exterior ſurface full of little cavities. There is an ornament called *ruſtic*, in our architecture, which reſembles this pretty much. The Bees indeed ſeem, to us, to attend leſs to beauty and elegance in theſe cells, than to ſolidity: they are ſo ſtudious with reſpect to the laſt mentioned article, that I don't wonder you ſhould conſider them as rude and heavy. Wax, which is employed with ſo geometrical a thriftineſs, in the raiſing hexagonal cells, is expended with profuſion in that of the apartments where the queens are to be brought up. The Bees are exceſſively laviſh, when they are to build for the grandeur and magnificence of their ſovereigns.

CLAR. This conduct pleaſes me infinitely. It agrees exactly with my own ſentiments, and thoſe of our countrymen.

EUGEN. Happy the king, happy the people where ſuch ſentiments are reciprocal!—I weighed one of theſe palaces, one of theſe cells, (which deſerves to be diſtinguiſhed by the epithet royal) with other cells in the hexagonal form; and find that the former weighed almoſt as much as an hundred of the latter. And yet, the royal cell with which I made the experiment on this occaſion, was not finiſhed; it not being carried on to its full length, nor was of the largeſt

ſize.

ſize. I believe ſome of the royal cells weigh as much as an hundred and fifty common ones. Does this weight frighten you?

CLAR. I have nothing to object to their employing one hundred and fifty times the quantity of materials, in raiſing a *Louvre*, than in building a plebeian houſe; but they don't ſeem, to me, to have choſen a convenient ſpot.

EUGEN. I cannot account for their reaſons. But I know that they don't ſeem to endeavour to be thrifty with regard to place, in building a cell which is to ſerve as the cradle to a queen. They ſometimes fix it, as here, in the very middle of the comb. Several common cells are ſacrificed, to ſerve as a baſis and ſupport to it. Generally the royal cells iſſue from the lower end of a comb. Some of them deſcend (in like manner, from one of the ſides) provided it does not touch the partitions of the hive. One thing I found certain, *viz.* that their largeſt end is uppermoſt; and that their length is almoſt perpendicular to the common cells. When a royal cell is only begun, 'tis pretty much in the figure of a goblet; or, more exactly, of the cup in which an acorn lies. Sometimes the cup has a ſtalk, like that of fruits. But the Bees leſſen the diameter of the cell, in proportion as they lengthen it; they alſo contract it more and more, in ſuch a manner that the lower end may be more taper than the upper. The lower end they leave open, till the ſeaſon for cloſing it comes; which is not till ſuch time as the worm that grew within it is ready for

Plate IX. Fig. 4. Lett. A.

Plate IX. Fig. 3. Lett. a. Ibid. Lett. A A.

Plate IX. Fig. 4. Lett. B,B.

Ibid. Fig. 3. Lett. a, o, o.

for transformation. The Bees make every one of these distinguished cells fifteen or sixteen lines in length.

CLAR. I suppose you defer, till another day, the informing me how 'tis possible for the Bee to live and support itself in a cell turned topsy-turvy, and open at bottom; how it is kept from falling out, as well as the paste or pappy substance.

EUGEN. That you shall know instantly. First, the paste belonging to queens is thicker than that of the other Bees; 'tis scarce fluid; and is the less so, as its bed is exceedingly thin. Hence 'tis in no danger of falling from the place in which it is laid. Secondly, when the worm, whence a Mother-bee will issue, is small, 'tis viscous and light enough to be kept and suspended in this clammy paste. In proportion as it grows, it touches more and more every part of the partitions of its cell, and presses them to the height in which it is situated. I observed to you, that the diameter of a royal cell always diminishes downwards. Consequently, when the worm takes up the whole diameter of the upper bottom of a cell, it cannot tumble out. To return to our royal cell. The Bees make it fifteen or sixteen lines deep. The superficies which is as yet but just sketched, and only in form of an acorn cup, is often smooth. It afterwards becomes rugged, and one would conclude, that the Bees had carved it into regular compartments. As the smoothing here gives them little trouble, and

Plate IX. Fig. 4. Lett B, B.

and they employ this ſort of work in the other cells; we may ſuppoſe that theſe compartments, which are an ornament in our architecture, is likewiſe conſidered as one by the Bees, and that they add it out of reſpect to their queen.

CLAR. Another thing which puzzles me only, (for I am perſuaded that the Bees extricate themſelves happily on theſe occaſions) is this: when a royal cell hangs at the bottom of a comb which is not yet extended to its whole length, how do they do to make it longer? Methinks this unweildy edifice muſt neceſſarily give them a great deal of trouble.

EUGEN. 'Tis impoſſible to act more dexterouſly (and this with the utmoſt ſimplicity) than they do. They ſtay till the female Bee has left it; after which they deſtroy the royal cell, and build ordinary ones over it. But as they leave the foundations, we plainly ſee that part of the comb where this happened; it being a little thicker in this place than any other, and there appearing a kind of knot upon it. Hence it may be concluded that, at certain times, we no longer perceive, in a hive, the royal cells which were in it at the ſpring ſeaſon of the year. Such are the particulars which experience, and a ſeries of obſervations have taught us with regard to cells. 'Tis generally ſuppoſed, that the cells of combs are the habitations which the Bees build for themſelves, and that each has its own. This opinion ariſes from its being obſerved, at certain times, that each cell has its Bee in it, where they lie

eaſy and motionleſs. But a cloſer examination will diſcover, (and for this purpoſe our glaſs-hives are vaſtly uſeful) that the chief uſe of the cells is not to afford habitations to the Bees. A great number of cells contain the young worms, and ſome are ſtopped up; and, of theſe, ſome contain *nymphæ*, and others honey. Others again which are open, ſerve as ſtore-houſes for the crude wax; as likewiſe for the honey given as daily food to ſuch Bees as work within; and ſerve likewiſe for ſuſtenance on thoſe days when cold or bad weather prevent the colony from going out of the hive. Such are the uſes to which theſe edifices are employed. We muſt enquire concerning honey and its nature; and theſe ſhall be the ſubject of our next converſation here.

CONVERSATION XIII.

Of the origin of honey; its gathering in, or harveſt: the two ſtomachs of the Bee: the ſtore-houſes of honey; the different qualities of it.

CLARISSA.

A Moment after I had left you yeſterday, Eugenio, I received a meſſage from a lady of my acquaintance. She ſent me word, that being informed of the ſtrong deſire I had, to inſtruct myſelf in the hiſtory of Bees, ſhe had ſent me the moſt compleat treatiſe ever wrote on this ſubject. You will ſuppoſe that I opened it inſtantly with the greateſt eagerneſs and curioſity. I read the title, which is as follows: *The wonderful government; or the commonwealth of Bees* *. I preſently imagin'd that your miſſion was at an end; and that I ſhould learn more in this book than you could teach me; eſpecially as I did not doubt but the author, who wrote ſince Mr de Reaumur, had profited by his obſervations and experiments. I thereupon began to peruſe it with great eagerneſs; eſpecially the part relating to the natural hiſtory of Bees. I was not a little ſurprized to find that the author, though ſo modeſt as to apologize

* *Le gouvernement admirable; ou la republiques des Abeilles. Paris, chez Thibouſt*, 1742.

logize for the defects which might be found in his ſtyle and erudition; did not prefer eaſy and unambiguous experiments, when made by clear, attentive eyes, to his own ideas; to ideas of a random kind, and to imaginary principles.

EUGEN. I know this book, and have peruſed it. The author appears to me a very honeſt, ſincere gentleman. Nevertheleſs, in matters relating to phyſicks; I mean with regard to the birth, generation, ſexes, *&c.* of Bees. I would adviſe you to adhere to what Mr de Reaumur informs us of this ſubject. However, you may keep this book, and place it, in your library, after the *maiſon ruſtique* (country-houſe). You there will find many valuable precepts, with regard to the working (if I may ſo term it) of hives; but it is not much to be depended upon, with reſpect to the natural hiſtory of Bees. For inſtance, he will teach you how to make good metheglin or mead with honey; but then very few particulars are related, concerning the nature of honey, its different qualities, its uſes as to life and health, and the ſtore-houſes in which the Bees reſerve their honey. You may call to mind that this is to be the ſubject of our preſent converſation; and chance has brought us hither very *à propos*. To begin then. It was antiently ſuppoſed, that honey was a dew which fell from heaven; but this is not the opinion, at leaſt of good writers, in the preſent age, experience having taught us better. It is found, on the contrary, that dew and rain are great enemies to honey;

honey ; that they mix with the honey'd liquor which I ſhall ſpeak to you of, and corrupt it. It is the ſame as with wax : the Bees collect the materials which form it from flowers ; but then they faſhion it in their ſtomachs, and it there aſſumes the nature of honey. In it's firſt ſtate, 'tis a ſap or juice digeſted and refined in the hollows of plants ; a juice, which ſweats through the pores, and thickens on the flowers. The Bees don't always wait till this ſubſtance has tranſpired ; they fetching it from the very reſervoirs where nature ſtores it. Theſe reſervoirs are a ſort of bladders or kernels, plac'd variouſly on flowers of different kinds. It is but of late years that botaniſts have diſcovered them ; but they have been always known to the Bees. Whenever a Bee goes into a flower which has ſome of theſe bladders, or reſervoirs, very full of honey'd liquor, ſhe ſometimes finds this liquor in its ſtore-houſes, ſometimes ſhed upon the leaves, and on the bottom of the flower. In ſpring we perceive trees, and among others the maple, whoſe leaves are all cover'd with a ſort of honey or ſugar, and with which they glitter. Whether this liquor be in the reſervoirs, or iſſued from it, it is the firſt ſubſtance or matter of honey ; it is this which the Bee goes in ſearch of and gathers ; therewith to compoſe a food, proper for the nouriſhment of herſelf and her companions. It would be forming a falſe judgment with regard to Bees ; and they would be very unjuſtly conſidered as lazy, in caſe, every time we ſee them return

return to the hive, empty footed; we then ſhould conclude that they had wing'd their way to the fields merely for diverſion ſake, and to riot on dainties; they frequently returning, on theſe occaſions, with a large proviſion of honey.

CLAR. I am greatly oblig'd to you, for giving me an opportunity of retracting ſeveral erroneous opinions I had form'd to myſelf with reſpect to Bees. I had often obſerved theſe inſects to return empty; which gave me a moſt unfavourable idea, with regard to their ſo much boaſted love for their community. This, indeed, was a circumſtance, concerning which, I intend to enquire of you.

EUGEN. We cannot be miſtaken with regard to thoſe who collect the proviſion of wax; the two large balls we ſee on their legs, being a teſtimony of this. But we cannot diſcover, in like manner, their proviſion of honey, this being ſhut up in their ſtomachs. Many a Bee who appears light, with reſpect to proviſions, is yet well furniſhed with them. Before I treat of the manner how this ſubſtance is converted into true honey, I muſt firſt ſpeak of the harveſt or proviſion made of it. The trunk is the inſtrument with which the Bee gathers it. I have nothing new to obſerve with regard to this organ, you being acquainted with it; and knowing that it is not a pump but a ſort of tongue which laps the liquid, and ſucks it in. This I obſerved, but have not yet ſhown it you; and therefore am tempted to give you this pleaſure.

Plate III. Fig. 3. Lett. A A.

CLAR. So, I ſuppoſe that we muſt have recourſe to magnifying glaſſes. Let us prepare ourſelves then for ogling.

EUGEN. To enable you to ſee diſtinctly the play of the trunk of a Bee, when ſucking in honey, I have brought this glaſs-tube, the diameter of which is about five lines. I will firſt rub it, in the inſide, with ſome little pieces of honey in different places; and this being done, I will impriſon therein a Bee, whoſe captivity will not leſſen his appetite; and ſo far from it, you will ſee her ſuck the honey, as it lies in the tube.

Plate XI. Fig. 1.

CLAR. Whilſt you are preparing your tube and Bee, I will tell you what I am now revolving in my mind; a wonderful Circumſtance which merits our utmoſt attention.

EUGEN. Nothing that heightens the glory of the Supreme Being, ought to eſcape us.

CLAR. Don't you admire as much as I do, how a Bee, that is ſcarce come out of her cradle, as it were; not having ſeen any object, and being wholly unacquainted with the world; ſhould yet iſſue from the inmoſt gloomy receſſes of her hive, the inſtant after her riſing to exiſtence; and fly directly to a flower, though three miles from the place of her abode; and there be able to find, in an inſtant, reſervoirs of honey which the eye of man cannot diſcover?

EUGEN. Your admiration is exceedingly juſt. No human reaſon, how enlightned and ſagacious ſoever, comes into the world with ſuch talents. Our inſects are a proof, that, if the author

thor of their Being has refuſed them an underſtanding like to that of man; he has compenſated for it, by ſending them into the world ready inſtructed; and much better inſtructed than if he had left to them (as is done to human creatures) the care of inſtructing themſelves.

CLAR. The Bees may conſequently boaſt their enjoying the ſingular honour, of learning from no one except the Creator of the univerſe.

EUGEN. Doubtleſs. Hence we can no longer wonder, that theſe inſects ſhould know ſo many things which ſurpaſs the limits of our underſtanding. See, our glaſs-tube is ready; and the Bee in captivity, who is now preparing to fall upon the honey with which I ſmear'd the walls of her priſon.

CLAR. It is my turn to make obſervations, and to inform you of the conduct of our Bee. Give me the tube and the magnifying glaſs. The Bee is now before me, in a very advantagious poſition. I perceiv'd, at the very firſt glance, that ſhe eats very heartily. But the buſineſs is to tell you in what manner ſhe does eat; how the trunk plays on this occaſion; whether ſhe chews, ſwallows, and ſucks. Firſt, I obſerve the trunk lying on the honey; and the extremity of the trunk ſtretching beyond the little honey'd heap. One would even imagine, that the Bee avoids dipping the extremity in queſtion into the honey. She turns her trunk in a bow-form; and it is the moſt convex part of this

Plate XI. Fig. 1. Lett. A. & Fig. 2. Lett. A.

bow, which ſouces and dips itſelf into the liquor. The inſect now rubs backwards and forwards the glaſs with the bow-part of her trunk; and, if ſhe goes on as ſhe began, not the leaſt drop of honey will be left. What a multitude of different inflexions does ſhe make with her trunk, and how wonderfully ſwift does ſhe move it up and down? One place, I perceive, is well lick'd, and quite done with; and ſhe proceeds to another. She now ſtops again at a ſecond diminutive drop of honey; ſhe runs the bow-part of her trunk into it, and draws it back again.

EUGEN. Obſerve, whether —

CLAR. Stay, I beſeech you: ſhould you interrupt me, I ſhall loſe ſight of my object. Behold ſhe now raiſes her trunk, ſtretches it forth, and draws it in. She throws, from time to time, the upper ſurface into a concave form; as though ſhe would give a ſlope or bend (towards the head) to the liquor ſhe has taken in. Hitherto I have always ſeen the extremity of the trunk; this extremity, in which there would be an opening if the trunk was a pump, I ever perceived above the honey; and it did not come near it. Should any partizan of the old opinions, now aſſert, that the trunk is not a tongue which licks and laps up, but a hollow or gutter pierc'd at one end; you may call me to your aſſiſtance; ſure of finding in me, a ſecond, who is able to defend the truth.

EUGEN. I find my own opinion ſo ſtrongly confirm'd, by what you now ſay, that I will not

ſcruple

ſcruple to affirm, that this trunk is a ſecond tongue, which we might call a hairy tongue (it being cover'd with a great number of briſtles) to diſtinguiſh it from the fleſhy one I ſhow'd you before, which is more like the common tongues. Now view, in large, (as drawn from the microſcope) what you perceived, in the tube, through the magnifying glaſs. You are now convinc'd, by your own eyes, that it is by theſe various motions or inflexions that this tongue gets together the honey'd liquor, and carries it to the mouth. By repeating this obſervation, you will eaſily diſcover, that it is on the top of the hairy tongue the liquor paſſes; and that the caſes of the trunk are not, (perhaps) made ſo much to cover it, as to be as ſo many edges or brims, and to form a canal for the conveyance of the liquor. It would argue too much timidity in us, not to venture to aſſert, that the Bee does not take honey from flowers, in a different manner from that ſpread on a glaſs. The difference which may be is this; the Bee, when in a flower wherein there is not honey enough diffuſed, employs the ſtrong jaws, which we know they have, to ſqueeze open the bladders containing the honey'd liquor. This inſect can uſe it to very good purpoſe, when it wants to hack the paper, which covers your boxes of ſweet-meats, as you yourſelf frequently complain. Why ſhould ſhe not employ it with regard to flowers, whenever it may be neceſſary to tear the membranes of which the honey bladders are compoſed? Such is the manner in which Plate XI. Fig 2. Lett. A.

the Bees procure the liquor wherewith honey is to be made. When this liquor, by means of the trunk, has pafs'd into the ſtomach, and continued ſome time there, it comes out from thence true honey. For we may very naturally conclude, that this ſubſtance does not iſſue from the Bee's body, ſuch as it entered; but that it is digeſted and concocted there (and this likewiſe is the opinion of Swammerdam;) which is the reaſon of its being thicker when it iſſues from the Bee, than when ſhe took it in. The Bee has two ſtomachs, the one to convert crude wax into wax properly ſo call'd; and the other to change the juice of flowers into honey. I could ſhow you theſe two ſtomachs.

CLAR. I ſhall be glad to view them, upon condition that you won't diſſect, for that purpoſe, living Bees. I ſuffer'd too much by the cruel diſſections of thoſe inſects, made by you to diſcover their ſexes.

EUGEN. You'll find that I intended not to
Plate XI. Fig. 3 give you the leaſt pain, ſince I have brought this draught with me, wherein you will perceive theſe two ſtomachs very diſtinctly. 'Twere needleſs to obſerve, that this figure is larger than the life, and was drawn from the repreſentation ſeen in the microſcope. I'll now explain the ſeveral parts of it to you. A is the *anus*, C the end of the *corſelet*, or that part where the breaſt ends. My deſign is to ſhow you all that lies between them, I mean the part call'd the Bee's *belly*, whence I have taken off all the ſcaly part from the

the rings which cover'd it. The conduit or gutter ſignified by the Letters V V, beginning by a neck and ending with a thick belly, in form of a bottle, is the Bee's ſtomach. The neck of this ſtomach is a continuation of what we call the *gullet*, or *conduit for food*; the ſwell'd part is the true ſtomach, as we ſee it when quite full of honey. The other conduit contiguous to it, divided by rings like a barrel, and diſtinguiſh'd by the letter E, is the ſecond ſtomach, or laboratory for crude wax. The honey-ſtomach is not always ſo turgid as you perceive it on this occaſion; and 'tis not ſo eaſily diſcover'd when empty. For this reaſon I have made a ſeparate draught of the ſame parts taken out of the belly. S is the neck or gullet; and, if you permit me to uſe the technical term, *Oeſophagos*. V is the honey-ſtomach, which, as you may perceive, is very ſmall, as there is little food in it. Next is the ſtomach of crude wax, which you'll diſcover eaſily by its rings. The part repreſented by the letter T, is a ſort of net-work or fringe of yellow veſſels, in that part where the ſecond ſtomach joins with the inteſtines. I is the laſt inteſtine, in which crude wax is frequently found, as likewiſe in the ſtomach, but never honey. A is the *anus*. Theſe particulars being known, you'll eaſily underſtand the reſt. The *Oeſophagos* throws the honey received by it into the firſt ſtomach, which is more or leſs ſwell'd, according to the greater or leſs quantity contain'd in it. When quite empty, it ſeems only a white, fine thread; Plate XI. Fig. 4.

but when well fill'd with honey, 'tis ſhaped like a bladder, with which children who live in the country are perfectly well acquainted, and are very fond of.

CLAR. 'Twas therefore after ſuch bladders that a little brother of mine us'd to ramble formerly, and which he was very dextrous in procuring. He has regal'd me very often with them, at the time that we were both children.

EUGEN. 'Tis particularly in the bodies of large honey drones that the largeſt bladders are found; and children hunt more eagerly after ſuch, than thoſe of the Bees.

CLAR. The Bees, conſequently, owe their ſecurity to the little riches poſſeſs'd by them.

EUGEN. Every flower furniſhes the Bee with only a very ſmall quantity of this liquor; ſhe being oblig'd to travel over many, one after another, before ſhe has taken all the quantity into her firſt ſtomach, that it is capable of containing.

CLAR. We have not found Ariſtotle or Pliny in an error this long time. Have they made no mention of the ſeveral particulars you have pointed out, and inſtructed me in?

EUGEN. We need not go farther, in order to find, in the former, ſubjects for cenſure. According to him, the ſame Bee does not go from one flower to another of an oppoſite kind; he does not go from a violet, for inſtance, to a primroſe; but always from one violet to another, from a lilly to a lilly, and from a roſe to a roſe.

But I have often ſeen Bees ſkud away, like butterflies, from flower to flower, without once regarding the ſpecies. However this be, as ſoon as the inſect has filled her ſtomach with a ſufficient quantity of honey, ſhe returns to her hive. The inſtant ſhe is enter'd it, ſhe ſeeks a cell in which ſhe may diſgorge and depoſit the materials brought by her. This leads us to inquire into the magazines or ſtore-houſes of honey. We are now coming to a wonderful article relating to the polity of our little inſects, and which certainly deſerves your enquiry. Figure to yourſelf a city, all the inhabitants whereof work only for the general utility; where each individual is diligent and faithful in carrying to the publick ſtore-houſes, the harveſt of the day; contenting itſelf with taking juſt what may be neceſſary for its own ſupport; where the people ſtore up, not only for the time preſent, but likewiſe for futurity; where repoſitories are found ever full, and always open for daily ſubſiſtance; repoſitories ſecurely ſhut up and ſeal'd for winter, and ſeaſons of ſcarcity.

CLAR. You put me in mind of a little fable I read formerly, which appeared very prettily work'd up, and to the following purpoſe. The waſps and hornets, once upon a time, form'd a kind of mercantile ſociety together; and propos'd, to the tenants of a Bee-hive, the ſtocking of their ſtore-houſes; they engaging to keep theſe granaries perpetually full, and well provided with crude wax and honey; which is as if we were

were to ſay, with regard to mankind, well ſtock'd with corn and wine. The Bee-ſenate being met, a hornet, an eloquent ſpeaker, diſplay'd before the aſſembly the mighty advantages which would accrue to the former from theſe propoſals. He laid a ſtreſs, eſpecially, on the numberleſs cares and diſquietudes which the Bees would be freed from by this means; that they might ſweetly ſleep away the whole morning, and ſpare themſelves long and painful journies. Accordingly an inſtrument was drawn up; and the Bees abandoned to the new-comers the proviſions already made, upon condition of being afterwards nouriſhed by them. However, at the expiration of the year, the waſps and hornets diſappear'd; and, with them, the honey and crude wax; they leaving only empty granaries, and the Bees ſadly lamenting their folly.

EUGEN. I don't doubt but that a proper application may have been made of this fable. But to return to the general utility: this foreſight of the Bees is known to all perſons, who, at the ſame time that they are rais'd to admiration applaud theſe inſects highly on this account. But what men imitate them? Many from a principle of avarice, and few from a view of ſerving the public. But let us leave moralizing, and reſume our ſubject. 'Tis on the brink or edge of one of the cells whoſe turn it is to be fill'd, that the Bee which comes back from the fields, ſtops: ſhe then thruſts her head in, and ſoon pours into it all the liquor brought by her. Mr. Maraldi obſerved very

very juſtly, that the part by which ſhe diſcharges the honey from her body, is over the trunk, and very near to the teeth; or, in other words, that the honey iſſues through the opening which we call the *Mouth*. In order that the firſt ſtomach of a Bee may throw out the honey contained in it, it muſt have the power of contracting itſelf ſucceſſively and alternately, in different parts; and it is endued with ſuch a faculty. This is aſſerted by me, becauſe I have made ſuch an obſervation on ſeveral living Bees, which I open'd for that purpoſe. A cell is very capacious, with reſpect to the quantity of honey which a Bee can pour into it at one time; and, for this reaſon ſeveral Bees come, one after another, and diſgorge what they gather'd and prepar'd, before one cell can be compleatly fill'd.

CLAR. Do they quite fill their cell with honey?

EUGEN. Methinks I gueſs the reaſon of your aſking this queſtion. You cannot ſo well conceive, how 'tis poſſible to quite fill, with a fluid, a goblet or cup turn'd on one ſide: for we may look upon cells as little cups or pots lying in that poſition.

CLAR. I really could not conceive how this was done.

EUGEN. There are two ways of filling them. The one relates to thoſe which ſtand always open; the other to ſuch as are to be clos'd. We may preſently ſee the manner how the Bees fill the former. I perceive, in our hive, a comb Plate X. Fig. 2.

comb placed very favourably for that purpoſe. 'Tis, as you ſee, ſet againſt one of the glaſs panes; and the cells contiguous to it are mutilated ones, whereof the glaſs makes part of the partitions, and ſerves inſtead of two of their faces. The tranſparent partition, or glaſs, gives us an opportunity of ſeeing the honey contained in it, and the manner in which it is lodg'd. Here's a cell half full. Obſerve that this laſt lay of honey, that ſurface towards its entrance, may be eaſily diſtinguiſh'd from the reſt; it looking like cream over milk; a thick lay. 'Tis exactly the ſame in all honey-cells, whether they have a ſmall or great quantity in them. This lay, by its thickneſs and conſiſtence, makes a ſort of lid or cover, which keeps in the honey, and prevents its running off. We may call this cover a *cataract*, as it performs the office of thoſe flood-gates which keep in the water.

Plate X. Fig. 2. Lett. P.

CLAR. This contrivance is excellent; yet this does not quite remove all my doubts. I am ſtill puzzled to know how it will be poſſible to fill this cell. Does every Bee, in proportion as ſhe brings new honey, beat down the *cataract?* Does ſhe put a new one in its place? Is a new one made by the inſect, every time ſhe brings in honey?

EUGEN. I am not ſurprized that, notwithſtanding all your good ſenſe and penetration, you have not been able to diſcover the plain and ingenious contrivance they have found, in order to fill, by inſenſible degrees, a whole cell; by ſtill employ-

employing the ſame cataract, without being obliged to deſtroy it, when new proviſion is to be brought in. A man, in order to diſcover this, muſt have ſeen it, and have learnt the practice from the Bees themſelves. Theſe inſects have a thouſand ingenious contrivances, which aſtoniſh us, when we have once found them; and after we have tortur'd our imaginations, to diſcover the manner in which they act on theſe occaſions; if we only view them at work, we are ſurprized to find that there is the greateſt ſimplicity in all their operations. This is juſt the caſe here. A Bee, who enters a cell half fill'd with honey which is kept in by a cataract, and wants to add to it the new proviſion brought in by her, lays under this cataract or honey'd cruſt, the two ends of her fore-legs; then bringing her head near to this opening, ſhe throws in all the honey ſhe was fill'd with. But before ſhe withdraws, ſhe mends with her legs the little opening made by her. Every drop of honey which each Bee brings, increaſes the maſs; and this, when enlarg'd, forces the cataract forward. As a thouſand things intervene in this way of ſtowing or heaping up the honey, inaſmuch as the cataract may be brought more eaſily backward or forward; for this reaſon the cataract is never perpendicular, but always ſloping. Among the cells fill'd with honey, ſome are to furniſh the quantity deſign'd for the daily ſuſtenance of the Bees; and others to preſerve that which is to ſupport them during a ſeaſon, when it would not be poſſible for them

Plate X. Fig. 2. Lett. A A.

to

to meet with any upon the plants. Even during thoſe months in which the moſt abundant harveſt might be gather'd, there are ſome days when the perpetual rains, or colds too violent for the ſeaſon, confine the Bees to their hives. 'Tis then they have recourſe to the honey, which they intended ſhould be firſt conſum'd. Thoſe whoſe toils prevented their ſtirring out, and to whom the honey neceſſary for their ſupport, was not preſented time enough by ſuch as brought ſome from the fields; the labouring Bees, I ſay, go to theſe cells, and take from thence what they want; but they never eat (except in ſeaſons of great neceſſity, and during a real famine) the honey contain'd in a great number of cells, eaſily diſtinguiſh'd from the reſt; I mean thoſe we term'd ſhut or clos'd ſtore-houſes. When once, Clariſſa, you are told the manner in which Bees build their cells; you will not be puzzled to know how they cloſe them. This is done only by a plate of flat wax, with which they ſhut the entrances. The ſame objection you ſtarted, with reſpect to the honey kept in the cells which ſtood open, occurs here. How will it be poſſible to fill a pot lying ſide-ways, with a fluid, and cloſe it afterwards? Tho' honey is a fluid, 'tis yet not ſo much ſo as water; it having a conſiſtency which prevents its running off on a ſudden; and eſpecially, when contain'd in a veſſel ſo narrow as a cell is, it can ſuſtain itſelf there ſo long a time as is requiſite for giving the Bee an opportunity of taking all the precautions neceſſary

neceſſary for ſecuring the honey laid up by her. This cataract or honey'd cruſt, which is thicker than the other parts, is brought inſenſibly to the brink or edge of the cell; and when the Bee perceives that the veſſel is as full as it can hold, ſhe then raiſes up its ſmall cover or lid of wax.

CLAR. Of what uſe is this little cover of wax, ſince the cataract alone is ſufficient to keep in the honey, and prevents its running out?

EUGEN. The Bees did not let me into the reaſon of this, but we may eaſily gueſs at it. Honey, when expos'd to the air, thickens and grows rough, hard and ſeedy. Now all honey kept in open cells, would become ſuch before the end of winter. The heat, which is conſiderable, found in a hive, might in a few months cauſe the greateſt part of the liquor to evaporate, to which its fluidity is owing; whereby the inſects would loſe the benefits that muſt naturally accrue from their oeconomy and provident care. Aliments, if intended to be kept long, muſt be ſhut up. The cataract would not be an obſtacle ſufficient to prevent the air from acting on the honey; but the ſmall waxen incloſure ſeals the veſſel hermetically; and by this means the honey may be ever preſerved freſh and fluid, ſo long as may be neceſſary.

CLAR. I wiſh there was writ over the door of every hive, an inſcription, in large characters, to the following purpoſe: *Counſel and advice to all who paſs by. Here are given rules, with regard to prudence and government, for preventing a dearth.*

This

This advice being repeated ſo often as men ſhould caſt their eyes on Bee-hives, would perhaps make them, at laſt, firmly reſolve to ſecure themſelves from the moſt dreadful of all calamities.

EUGEN. This is excellent advice; but we muſt add to it the fable of the waſps and hornets.

CLAR. Thus Bees furniſh us with various and very important bleſſings. The obſervance of prudent rules may ward off the moſt dreadful of evils, and ſupply us with an agreable food. Being fond of honey, and its taſte pleaſing me exceedingly, I ſhould be glad to know how far you think it may conduce to health.

EUGEN. I will not pretend to adviſe you in an art of which I have but a very imperfect knowledge. But I'll here give you the ſubſtance of what two of our moſt eminent phyſicians, Meſſieurs *Hecquet* and *Andry*, have wrote on this article. The antients call'd honey a gift of the gods; a celeſtial dew, an emanation from the ſtars: it ſerved them inſtead of ſugar, which was unknown in thoſe ages. They conſidered honey as an antidote, a panacea, or univerſal remedy; and imagin'd it capable of preſerving from corruption, and of prolonging life. Herodotus ſpeaks of a cook who, in order to preſerve his viands from corruption, employ'd only honey for that purpoſe. Many ſages, as Pythagoras, Democritus, *&c.* fed on nothing but bread and honey; from a perſwaſion that this was an infallible ſecret for lengthening their days, and for maintaining their mind and ſenſes in full vigour.

vigour. Auguſtus having one day aſked Pollio, by what ſecret he had arrived to ſo vigorous an old age; he replied, that he had fed upon honey and rubb'd himſelf with oil. In fine, the antients imagined they perceived ſomething divine in honey; whence it was conſidered as a venerable and ſacred food.

CLAR. I am well pleaſed with myſelf, for agreeing in opinion with the antients; and fancy that, had I lived then, I ſhould have turned Pythagorean merely thro' luxury.

EUGEN. I adviſe you at this time of day, for your health-ſake, to copy another ſect among the modern philoſophers: for this food, ſo wholeſome and delicious to our anceſtors, is no longer ſo with regard to us. This gift of the gods, this celeſtial dew is now very much neglected, and left to the poor. If the apothecaries furniſh their ſhops with it it, 'tis only to apply it to a uſe diametrically oppoſite to that of the antients, or at moſt for ptiſans. And, indeed, it muſt be own'd, that it now ſuits few conſtitutions. Honey heats and dries, in what manner ſoever taken, whether by way of food, or as ſeaſoning. It ſuits none but phlegmatic conſtitutions; old men, or thoſe who, by ſickneſs or other cauſes, abound in groſs, viſcous humours. But perſons of a bilious complexion, according to the two phyſicians above-mentioned, ought not to uſe it.

CLAR. How can it be poſſible, that what was ſo good and ſalutary with regard to the health

of our anceſtors, ſhould be ſo pernicious in this age; or, at leaſt be abandoned as of no benefit. Is it the men, or the Bees, who have changed their nature?

EUGEN. This is owing, according to Dr. Hecquet, to our different manner of living: this phyſician declares that mankind, in the preſent age, are more gluttenous; and that ragoos (our perpetual food) give the blood a continual tendency to inflammation; that the moſt ordinary food is degenerated from its antient ſimplicity; that honey, being filled with volatile particles, finds the blood often too bilious, lively, and inclined to fermentation.

CLAR. Thus I am ſentenced to abſtain from honey, merely becauſe I don't live after the manner of our good forefathers.

EUGEN. That's according as you are phlegmatic or bilious.

CLAR. Methinks I am rather phlegmatic.

EUGEN. You may then, according to Dr. Hecquet, continue the uſe of it. By the way, notwithſtanding the veneration due to the memory of this illuſtrious phyſician, we yet may conclude, that he amplifies a little in his deciſions againſt honey. I myſelf ſhould be apt to join with the multitude, who look upon it, when of a good ſort, as wholeſome food enough. Since therefore you are ſo fond of it; and can run no riſk, if I miſtake not, in continuing to uſe it, (during ſickneſs excepted;) it may be be proper to inform you of what is obſerved in general, on this

this kind of food. Some countries are more favoured by nature than others, with regard to animals and vegetables of every kind. The antients had a particular eſteem for the honey of Attica; that of Hymettus was famous, and has been frequently ſung by the greateſt poets. The beſt honey in France (we are told) comes from Narbonne; or rather Corbiere, a ſmall town nine miles from that city. This honey is white, light, delicate, fragrant; and has ſomething aromatic in its taſte.

CLAR. I uſe this honey much more than any other.

EUGEN. And 'tis the very honey we are ſpeaking of, which Dr. Hecquet declares to be the moſt prejudicial of any, becauſe of its good qualities.

CLAR. Your phyſicians are a ſtrange ſort of people, and fond of contradiction.

EUGEN. The phyſician juſt mention'd has reaſon on his ſide. He tells us, that as honey *abounds with volatile particles, 'tis therefore more apt to be carried along by the rapidity of an intemperate blood, and ever ready to ferment.* This agreeable taſte, which makes it be preferred to all others, is owing to the aromatic plants, (ſuch as roſemary and balm) with which the neighbourhood of Corbiere abounds. 'Tis certain that taſte is a very bad judge, with regard to the wholeſomeneſs of aliments. Whenever, therefore, you would have recourſe to honey, you muſt prefer the new to the old; that of ſpring or ſum-

mer, to the honey produced in autumn; the white to the yellow; that which froths but little in boiling, to the other which froths much; the honey which is ſweetly-ſower, to that wholly ſweet; finally, the honey whence a gentle ſmell is emitted, to that which is too ſtrong; the latter being commonly adulterated. All kinds of honey are conſequently not indifferent, and ſome may even be vaſtly pernicious; and of this we have ſo very memorable a ſtory, in Xenophon, that I cannot forbear relating it. This famous author, in his hiſtory of the retreat of the ten thouſand, informs us, that his ſoldiers being arrived near Trebizond, found a great number of hives; and were not ſparing of the honey. Immediately they were ſeized with a purging both upwards and downwards, and grew light-headed; inſomuch that ſuch as eſcaped beſt, reſembled men intoxicated with liquor; and others, frantic or dying perſons. The ground was then covered with bodies, as after a battle; nevertheleſs not a ſoldier died, and the diſtemper ceaſed, on the morrow, at the very ſame hour it began; ſo that the men roſe up the third and fourth day; but exactly like perſons who had taken a very ſtrong doſe of phyſic. Mr. de Tournefort, that celebrated botaniſt, who viſited this place, in his voyage to the Levant, is of opinion; that the plant whence the Bees extracted ſo noxious a ſort of honey, is one of the ſpecies called, by the botaniſts, *Chamærododendros*.

CLAR.

CLAR. I ſuppoſe you won't deſire me to get this name by heart?

EUGEN. I ſhall not, provided you don't inſiſt upon my procuring you a ſight of this plant; for, very happily, none of it grows in our country.

CLAR. Since it is found that various plants give different taſtes and qualities to honey, ſome of which are noxious and others ſalutary; have not men ſtudied which of them are moſt ſuitable?

EUGEN. This ſhall be mentioned, when we come to the government of hives. I will only obſerve (by the way) that I endeavoured to try, whether it were not poſſible to make Bees produce a honey, more poinant in taſte than the beſt honeys we are acquainted with; one that ſhould come nearer to the taſte of ſugar. For this purpoſe, I gave my Bees an opportunity of carrying ſugar, inſtead of honey, into their hives; during a ſeaſon, when they could ſcarce get food enough for themſelves in the fields. I lodged a ſmall commonwealth of Bees in a glaſs-hive; near which ſtood always a plate, wherein was ſugar, diluted by water, to the conſiſtency of ſyrop. The inſects, who before the abovementioned ſupply, would have been forced to make far diſtant excurſions, which had produced them very little; took up with the liquor that was ſo near at hand, and in ſufficient quantity. Accordingly my Bees made ſmall honey-combs; and, ſome days after, moſt of the cells of one of

theſe combs was filled with honey. Immediately I took away this comb, containing the honey, which I imagined would be quite ſugary. Its taſte, indeed, was more poinant than that of ordinary honey; but I afterwards found a more eſſential difference between them, which is, that though I have kept the honey in queſtion four years, 'tis no ways ſeeded, as common honey is; but continues clear, tranſparent; fluid as at firſt, and does not thicken like the true honey. I muſt tell you that I have ſeen Bees, in a ſeaſon when they could get honey enough from the fields, deſpiſe powder'd ſugar, with which I filled plates, and ſet near to very populous hives. Honey differs ſtill more in colour than in taſte. The whiteſt is moſt eſteemed, and to this, time gives a yellowiſh tinge. Some is naturally more or leſs yellow. I obſerved one ſort, whoſe colour was much more ſingular; I never meeting with any, except that time, of this hue. This honey appeared ſo very green in the cells, that one would have thought it had been filled with the juice of the greeneſt herbs. Farther, its taſte was more agreeable than that of the honey uſually met with. Nevertheleſs, this honey which appeared ſo very green in the cells, was but of a ſlight, greeniſh caſt, when laid in veſſels of white glaſs.

CLAR. But, Eugenio, this green honey muſt be a very great rarity. I'll certainly procure ſome, though I ſhould be obliged to ſet all the peaſants of my village at work for that purpoſe.

EUGEN.

EUGEN. Is it, Clariſſa, the greeneſs of this honey, or its being more exquiſite to the taſte, that excites your curioſity?

CLAR. 'Tis becauſe it is ſo very ſeldom found. You have not given a looſe to your criticiſms this long time; and, very luckily, you now ſet about it late, and at an hour when we muſt part. Being naturally good natured, I ſhall excuſe this little fling; upon condition that I anſwer it at a proper opportunity. In caſe you have any thing farther to inform me of with regard to honey, it muſt be poſtponed to another time.

EUGEN. I have told you every thing I know concerning this ſubject. Hitherto we have examined the materials; or, if you like the term better, all the utenſils relating to a hive; every thing which concerns the building of the little edifices; their form, and their uſes; the origin and quality of the food of Bees; with their manners and inclinations. We next muſt examine their way of living; and, as it were, their domeſtic life; from the ſettlement of one ſwarm, to the going out of another.

CONVERSATION XIV.

Of the labours and occupations of Bees in the hive.

CLARISSA.

METHINKS, Eugenio, I have already hinted, that the circumſtance which gives me moſt delight, in the peruſal of hiſtories and travels, is to inform myſelf of the interior of men; to look (according to the common phraſe) into their ſouls; to learn their manners, cuſtoms, genius, talents, way of life, and even their domeſtic concerns. Theſe particulars are infinitely more entertaining to me, than thoſe of their wars and conqueſts.

EUGEN. 'Tis from this part of hiſtory that perſons, in our ſtation, may acquire ſuch knowledge as is of greateſt advantage to us. Battles, ſieges, the conduct of armies, marches, retreats, ravages, burnings; the laying waſte of provinces, the ſubverſion of monarchies; all theſe, I ſay, are incidents whence we cannot reap any inſtruction: the moſt they can do, is to excite our wonder or compaſſion, and too often our indignation; they being quite different from any thing which happens in our own families, and the ſocieties of which we are members. But the care which parents took, in the reign of Cyrus,

with regard to the education of youth; that love for our country, of which the Romans have given us ſo many and ſuch rare examples; the frugality of the Scythians; the modeſty, ſo dear to the Chineze; the frankneſs and ſincerity, for which the Swiſs-Cantons deſerve ſo much applauſe; the ſobriety of the Turks: In a word, the perpetual labour; the love for the public good; the oeconomy, vigilance, and foreſight of the Bees; their tenderneſs, and the reverence they ſhew to their ſovereign; all theſe afford us uſeful inſtructions, and examples fit for our imitation. The life led by the Bees is almoſt a treatiſe of morality.

CLAR. You have ſuggeſted to me a ſcheme, for the executing of which your aſſiſtance will be neceſſary. If we omit certain particulars in the life led by Bees, which are not very proper for us to copy; there would be enough left for us to draw up (from thence) a little book on this ſubject, under the following title: *The hiſtory of the Bees, deſigned for the inſtruction of youth.*

EUGEN. We'll ſet about it whenever you pleaſe. In the mean time, I'll proceed in informing you of what I have to ſay farther, with regard to their actions. I cannot finiſh the relation of the ſeveral things done in a hive, (from the ſettlement of one ſwarm, to the iſſuing out of another) without repeating ſeveral articles particularized by me before. But this I'll do as ſuccinctly as poſſible, in order that my repetitions may be leſs tedious. Our converſation, agreeably to the plan I this day laid down, ſhall relate

to

to the labours and employments of Bees, and this in the ſhorteſt compaſs as I can. The inſtant a ſwarm is fixed in a hive; when its government is once ſo well ſettled, that the Bees are certain of poſſeſſing a fruitful and only queen; the three kinds of Bees devote themſelves reſpectively, to the ſeveral functions for which nature deſigned them. The labourers divide the work between them. Some fly to the fields, there to ſeek for wax proper for building cells; others get virgin-wax, to ſtop the chinks and holes in the hives: theſe ſeveral materials they bring to the common habitation, and give them to other Bees, who inſtantly haſte and apply them to their proper uſes. Whilſt this is doing, other Bees go to the repoſitory of honey, whence they firſt take (as it is juſt they ſhould) ſo much as may ſuffice for their own nouriſhment; and carry the overplus to feed ſuch as are working within, and to fill their ſtore-houſes. Whilſt the labourers are thus buſied, either in building ſtore-houſes, and filling them with proviſions, or in making cells to receive the expected poſterity; the Mother-bee is employed, on the other hand, in propagating the ſpecies: and is wholly taken up with ſkudding from cell to cell, in every one of which ſhe drops an egg. She ſometimes begins to lay, on the very morrow after her arrival in the new hive. The labourers have enough to do, to provide her, during theſe firſt days, with cells ſufficiently to lay her eggs in. Whilſt ſhe is engaged in this important occupation, ſhe is not once left by her

little

little court. You may call to mind that the occupations of this little court are, to preſent their queen with honey; to clean her; to ſooth, and do her all the kind offices which a good mother may juſtly expect from tender and affectionate children; and, in fine, to divert her from all ſuch cares, as might interfere with that which ſhe herſelf only can diſcharge.

CLAR. 'Tis really buſineſs enough, to be deſtin'd to bring forth two hundred children daily; and therefore 'tis fit ſhe ſhould have female attendants, to look to her perſon.

EUGEN. Whilſt that the Bees are building cells, and the queen gives them hopes of having a numerous poſterity; the males or drones make a proper uſe of the ſix weeks, or thereabouts, of life allowed them; computing from the day on which the colony was ſettled. The ſole employment of theſe (after that to which the queen thinks proper to admit them) is to eat, drink, ſleep and make merry. Their time being expired, they then will be extirpated, either by death or a precipitate flight, to which they are ſentenced. The toils, the proviſions, the harveſts, the care of their habitation relates not to them; this being the buſineſs of the artificers to whom I return. Scarce has beautiful Aurora darted her firſt rays and gilded the horizon, but the Bee, ever induſtrious and an early inſect, is on her feet, and ſoon upon the wing. 'Tis a pleaſure to ſtand, at day-break, before the mouth of a hive; and to behold the joy and ſprightlineſs with which this diminutive

minutive people leave their gloomy manſion, where they had paſt the night, and fly into the fields. In an inſtant the whole air is filled with them. Which way ſoever you direct your eye, every Bee has her flower, whoſe ſweets ſhe rifles. During the months of April and May, our labourers work inceſſantly, from morning to evening. No time is loſt in the ſpring; for that ſeaſon being mild and favourable, our inſects make a proper advantage of it.

CLAR. An excellent leſſon for youth, who imagine that the ſpringof life was deſigned for nothing but pleaſure.

EUGEN. But aſſoon as the months of June and July are come, and the violent heats of ſummer begin to be felt; the greateſt toil is, from the dawn till about ten a clock. 'Tis not but that we always meet with ſome, who, fired by a love of labour or that of their community, work in the hotteſt part of the day, and return loaded with booty; but the number of theſe, in compariſon of the whole colony, is inconſiderable.

CLAR. You would make me apt to fancy that there are among Bees, as among mankind, ſome conſtitutions more robuſt, and more inured to toil than others; that there are Egyptians and Ethiopians among theſe inſects, with regard to whom the burning rays of the ſun are but a moderate heat; and, at the ſame time, Frenchmen and Germans, who don't chuſe to leave their temperate Zone.

EUGEN.

EUGEN. I would not have you conſider theſe particulars in this light. There are indeed Bees in all nations. The Ruſſians have colonies of theſe as well as the Egyptians. The ſun, who ſcorches the Lybian plains, ſees fleets of Bees ſailing up and down the Nile; and, on the other hand, the air of Ruſſia, though ſo piercingly cold, does not drive away thoſe with which their foreſts are peopled. What I mean is this. The Bees would doubtleſs meet with as much duſt (on flowers) at noon, as they would find in the morning. Theſe particles, when dried by heat, might be more eaſily taken off; but then it does not ſuit a Bee's purpoſe to gather them when they are too dry, becauſe they could not eaſily unite them together, and form a maſs of the whole. This may be done much eaſier, at a time that the particles in queſtion are ſtill moiſtned by the dews that fell in the night; or by the fluid which tranſpired through them. Such Bees, therefore, who bring back pellets of wax at noon, had met with them in wet and ſhady places; the flowers growing in which are as moiſt and freſh, during the hotteſt part of the day, as others in the cool of the morning. 'Tis true indeed, that, at the beginning of a ſettlement, the harveſt or proviſions are got in at any hour: be the heat ever ſo violent, wax, crude-honey and virgin-honey, muſt be procured; and for this reaſon, as I obſerved, becauſe their work, during this infancy of things, requires the utmoſt diſpatch. 'Tis their buſineſs, at theſe ſeaſons, to ſubſiſt, to lodge,

lodge, to ſhelter themſelves; and make cradles or repoſitories for their younglings, whoſe birth is at hand; four exceedingly important articles, which cannot admit of the leaſt delay. And accordingly, on theſe occaſions, our inſects ſpare neither pains nor fatigues to procure themſelves the requiſite neceſſaries; a Bee does not repine at a journey, though of a league, merely to gather a pellet of wax, no bigger than a pin's head. But when the community are once ſettled to their wiſhes, the purveyors make choice, for the getting in proviſions, of ſuch times and ſeaſons as ſuit them.

CLAR. I applaud them for it; and would not have any one be more laviſh of his toils, than of his repoſe. Is it not during theſe long excurſions, that the Bees have recourſe to contrivance, which I have often heard mentioned? I mean, to take up a little ſtone between their legs, and fly with it; in order that their bodies, by becoming thus weightier, may be leſs buffeted by the winds.

EUGEN. You'll ſoon be ſatisfied in this particular, when I ſhall have told you how they act in bad weather. The ſeaſon is now very beautiful, the heat is temperate enough, our hives are well ſtock'd, and our Bees lively and at high work. You may perceive, at their doors, a concourſe of inſects, greater than that of men in ſuch places as are moſt frequented. Some are returned from the fields, laden with materials and proviſions; whilſt others are upon the wing, in queſt of the like

like things. You see them now wholly employed in going backward and forwards; but then the season is, at intervals, so variable, that it will not always permit them to do this. It sometimes happens, at a time when the Bees are very assiduous and busy, that they cease their work on a sudden, and not a single Bee stirs out; on the contrary, you perceive them hurrying back in, on which occasion the crowds are so prodigious, that the doors are too small for them. Now, whenever you perceive so unexpected a return, look up to the sky, and you'll soon discover the cause why the insects came home so very abruptly; you'll perceive some of those little black clouds, which denote impending rain. Whether the Bees judge, as we do, of these clouds from their eye; or are informed of their approach, by some sense of which we have no idea; they generally anticipate a storm, and shelter themselves. However, some of them always fall a victim to their feebleness; or, hurried away by a passion for booty, are carried off by the storm, and perish in it. But the Bees, in general, foresee rain; and avoid it by returning home as fast as possible, or by taking shelter under the leaves. 'Tis these tempestuous seasons which made Aristotle, Pliny, and some other authors fancy, that Bees had found an expedient to secure themselves from the violence of the wind; and that, to prevent their being its sport, they used to bal-

laſt themſelves, (as it were) before they ſet out upon their flight, with a ſmall ſtone placed between their legs. A Bee's life abounds with ſo many things purely miraculous, that there is no occaſion for us to employ fiction to enrich it. The article, of the very ſmall ſtones, is a mere ſtory; the Bees never employing any ſuch for the purpoſe here mentioned.

CLAR. Methinks, Eugenio, you are too haſty in your aſſertions: for I can aſſure you, that the ſuperintendant of my hives (you know this is old James) affirmed this to me, as fact, and declared that he himſelf had been eye-witneſs to it. As he was one day walking in my garden with me, he took up a Bee which laid dead at my feet. He then ſhewed me the little ſtone, with which it had been freighted, lying betwixt its legs.

EUGEN. Old James may ſerve to convince you, that all people have not eyes; and that many who affirm, *I have ſeen*, ought not to be credited the more on this account. Had the honeſt old fellow clapt his ſpectacles upon his noſe, and ſurvey'd this object nearer, he perhaps would have diſcovered his error, which many others fall into likewiſe. I will now inform you of the circumſtance which occaſioned his miſtake; as Swammerdam has very well obſerved. There is a ſpecies of Bees who build their neſts, with mortar, againſt walls. Theſe neſts are pretty nearly in the form of half a pigeon's egg. The Bee

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in queſtion is a true maſon, who makes mortar with gravel and diluted earth. Whilſt the inſect isthus buſied, we often ſee her in the air, or reſting on ſome place, with the materials ſhe carries. If we look at this inſect but tranſiently, we eaſily miſtake her for the true Bee; as did the ſuperintendant of your hives, and Ariſtotle, Pliny, *&c.* Theſe obſervers, who were too precipitate in their judgments, thinking this ſtone belonged to the Bee, ſuppoſed it applied to a uſe for which it was never intended. Had they been patient enough to follow the inſect with its ſtone, and to ſee the uſe for which it was allotted; they would have perceived that it was flying towards a wall, and ſeen a half-globe raiſing againſt this wall: in a word, they would have found, that there is a very diſtant, and very imperfect reſemblance, between this Bee, and that which produces honey. Let us ſtrike this fiction likewiſe out of our legends, and keep to ſuch particulars as are true, *viz.* That the Bees ſecure themſelves from a ſtorm as well as they can; and that the beſt ſecret poſſeſſed by them, is to return, on theſe occaſions, with all poſſible ſpeed to their hive. When the ſeaſon is ſo favourable, as to permit our inſects to follow their works as uſual, agreeably to their inclinations; a prodigious and uninterrupted concourſe of them is ſoon loaded with proviſions. Some bring virgin-wax to ſtop the chinks and crannies of the hive. I have nothing to add to what I before obſerved upon this article. Others are freighted with honey; and the

veſſel in which they bring it is their own ſtomach. A Bee does not always unload her honey in the cells; ſhe frequently getting rid of part in the way. Whenever they meet with ſome of their companions who want food, and had not time to go in queſt of any; they halt, ſtraiten, and ſtretch out their trunks, in order that the aperture by which the honey iſſues, may be a little beyond the teeth; and they force out the honey through this opening. The other Bees, who know very well that it muſt be taken in here, apply the extremity of their trunks, and lap it up. Some of thoſe inſects are frequently ſo zealous for furniſhing the ſtore-houſes, that they ruſh at once into the hive, without offering the leaſt portion of their honey to any one: If theſe happen to be met with by ſome of their thrifty, induſtrious brethren, who are in immediate want of food, and cannot go in ſearch of any; the latter ſtop them, they pull them about, bite them; and never leave them till they have thrown up, in their favour, all the proviſion got by them. A Bee who has not been ſtopp'd by the way, often goes to the work-ſhop of the labourers; and offers them honey, to prevent (as one would conclude) their being reduced to the neceſſity of leaving their work, in order to go in queſt of ſubſiſtence; otherwiſe ſhe goes and lodges what ſhe has got in the ſtore-houſes. Such Bees as bring crude wax, ſometimes ſwallow it by the way; but they generally ſtay till they are arrived in the hive, there to conſign it to the toilers who

ſwallow

ſwallow this wax, and lodge it in their ſtomachs, in order for it to acquire the true quality of wax; or elſe they themſelves go and depoſite it in ſtore-houſes, to uſe it on proper occaſions. But this deſerves a more minute deſcription. A Bee who arrives with two pellets of crude wax, no part of which her companions had taken from her, enters an empty cell; and then, with the extremity of both her middle feet, looſens the two balls from her large hinder legs, and leaves the former at the bottom of the cell. The Bee, the moment ſhe has got rid of her two little burthens, ſets out inſtantly, either upon ſome new work; or haſtens to thoſe Bees who are recruiting their ſtrength, by taking a deſerved and neceſſary repoſe. But ſcarce are the two balls diſcharged in a cell, when another inſect comes into it immediately, and ſometimes makes a conſiderable ſtay there. We cannot ſee how this Bee is then employ'd; but after ſhe has left the cell, we may naturally gueſs what has been doing. The two pellets are then kneaded together in one maſs or lump; and this had been drove to the bottom of the cell; had been preſs'd or ſqueez'd, and its ſurface ſmooth'd. Whenever we ſpy two balls of crude wax in a cell, it is a certain ſign that it is allotted for a ſmall ſtore-houſe, and is to be fill'd with ſuch materials. Till ſuch time as it is quite full, the Bees come, one after another, and there unload their proviſion of crude wax; which other Bees knead, ſqueeze, and ſtow up, after having diluted and bound it together

with honey. Sometimes the inſect who brings the two pellets undertakes the doing of all this. Whilſt theſe things are performing, other Bees are employ'd in building of cells, others in repairing them; and others again bring the pappy ſubſtance for the younglings, againſt the time that the eggs ſhall be hatch'd. We have ſpoke of theſe ſeveral particulars before, and more largely. The ſtomach of the Bees is the moſt eſſential utenſil for their domeſtic concerns, and of the greateſt ſervice to them. It is properly, at one and the ſame time, their kitchen and laboratory. I obſerved to you before, that there are two of theſe. In one of them, they transform crude wax, partly into food, and partly into wax properly ſo called. In the other, the honey'd ſubſtance changes, in like manner, either into their own food, or into true honey. It is likewiſe in this laboratory that they make various kinds of paſte or pappy ſubſtance, according to the different age of their younglings, and even purſuant to the dignity of perſons; ſuch as are made for their queens being very different in taſte from thoſe of the ordinary kind. It is not in the nature of our labourers to perform any work ſlowly: every thing done by them is executed with ſuch prodigious ſwiftneſs and elacrity, that one would ſcarce think it poſſible for them to go through their toils, if we did not know that they divide it between them, and reſt themſelves by turns.

CLAR.

CLAR. You ſhewed me in our firſt converſation, the manner in which they take this reſt. This is done, if my memory fails me not, by ſuſpending themſelves in a groop or cluſter. I now perceive them in that poſition in the hive before us.

EUGEN. Would you believe, Clariſſa, that I knew ſome very ſenſible people, who had taken it into their heads to imagine, that Bees had their working days and holidays alternately? That ſuch as had worked one day, did not toil the next; at leaſt, that the ſame Bees did not go every day out of the hive? Tom. I. Plate I. Fig. 1, & 2.

CLAR. Suppoſing I ſhould be of the ſame odd opinion with theſe people, how could you convince me of the contrary.

EUGEN. Though this opinion is not built on one ſingle proof, I yet will combat it ſeriouſly, ſince you ſeem to honour it with your protection: and this I will attempt by a calculation, which you may object to as you ſhall think proper.

CLAR. If you perplex me with calculations, I promiſe you that our controverſy will ſoon be at an end.

EUGEN. You grow too ſoon weary of your pleaſures. But the ladies have many reſources on theſe occaſions. I will now furniſh you matter wherewith to exerciſe your ſagacity. There would be ſome probability in your opinion, if the number of Bees who iſſue daily from a hive, was leſs than that of all the Bees contained in it; for we then might ſuppoſe, that

part of them continue the whole day at home, whilſt the reſt are buſy in the fields. But, in caſe the number of thoſe who go abroad, is equal, or greater than that of the total number of ſubjects who conſtitute the commonwealth; it is more natural to conclude, that the Bee who comes loaded from the fields, repoſes herſelf ſometime, and returns afterwards to her labour; than to imagine that ſhe continues the ſame toils during the whole day. Now, in order to ground my opinion with the greater probability, I thought I needed but enquire, pretty nearly, into the proportion between the number of Bees, who iſſued daily from the hive, every day that is proper for working; with the total number of the Bees contained in the hive. To diſcover this, inſtead of numbering thoſe who iſſue from it; I counted how many returned to it, which amounts to the ſame, and is eaſier. I computed, at different hours of the day, and in various hives more or leſs populous, the number of Bees who returned to their hive during a certain number of minutes. You will ſuppoſe that this number was not exactly equal. I have ſeen an hundred Bees, more or leſs, enter a hive during the ſpace of a minute; ſo that I think this number (an hundred) may be taken as a mean term. You know that there are ſixty minutes in an hour. If therefore one hundred Bees iſſue out every minute, conſequently ſix thouſand will go out in an hour. Theſe inſects ſometimes iſſue forth, during the long days, at four

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in the morning; and do this inceſſantly till about eight in the evening, which make ſixteen hours. But as they don't ſally out, during ſome minutes, in ſuch numbers, I will ſuppoſe them to go forth fourteen hours only. Now, if ſix thouſand Bees iſſue out every hour, conſequently eighty four thouſand will ſally forth in fourteen hours. Nevertheleſs, the hive from which I made this calculation, conſiſted but of eighteen thouſand Bees. Conſequently the number of eighty four thouſand, which came into the hive, could not be made, except by ſuppoſing that every Bee iſſued out four times a day, at leaſt, and ſome five times, in order to get proviſion. By other computations, made on leſs populous hives, I was convinced that the ſame Bee might go forth ſeven times every day. In fine, you know that a great number of theſe inſects are employ'd about other works in the hive. Hence you may infer, that if a great number continue without labour, theſe are not long compoſed of the ſame Bees; that in proportion as ſome join the main Body, in order to ſtand ſtill; others leave it, and return to their work.

CLAR. You are wonderful, Eugenio, at calculations; and I know no man but yourſelf who could have thought of ſuch. Nevertheleſs, I am not quite clear as to the laſt. Are they all the Bees, belonging to the ſame hive, who undertake five, and even ſeven, journies every Day? Are not ſome of them for ever ſedentary? I imagine that the different labours of the Bees are

ſuited to their various talents. I ſuppoſe, for inſtance, that ſuch as go into the fields are the moſt robuſt, and that theſe are the peaſants of the republic; that thoſe who are of the claſs of architects build the cells; that ſuch officiate, as nurſes, who are not qualified for other employments; and that thoſe who had the greateſt politeneſs, the nobleſt carriage, and were beſt ſkill'd in flattery, compoſed the queen's court.

EUGEN. I have not made experiments and calculations ſufficient for clearing up theſe points; and therefore will only tell you my opinion which I imagine very probable. I take it for granted, that all the working Bees are born with the ſame talents; that theſe ſeveral talents are in the ſame, or very near the ſame degree of perfection, in all theſe inſects: that chance, or occaſion, diſtributes the various works; and that all the Bees labour indifferently upon them, accordingly as things preſent themſelves. We may even ſuppoſe, that they unbend or eaſe themſelves, of too-fatiguing toils, by another that is leſs vigorous; and continue ſome hours unactive; in like manner as men, who frequently proceed to a lighter taſk, after being engaged in a very laborious one; and then to ſleep. Thus theſe cluſters of Bees which you perceive clinging one to the other, and who are at reſt, at the ſame time that others take ſo much care and pains; enjoy, in all probability, a repoſe which they juſtly claimed for their paſt toils; they recover new ſtrength, in order that they may be enabled to labour afreſh; and to relieve other Bees, who being

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actually employ'd in fatiguing exercises, will want to repose themselves in their turn. We must not forget to rank in the number of the employments and labours of the Bees, the care they have to keep the hive clean; to carry off their dead and the filth, of every kind; to drive away insects, to feed their younglings; to stop the cells, when the season for the worms to change into *nymphæ* is come; to clean them; and carry off their leavings, after the *nymphæ* are transformed into Bees; and to prop up or support such combs as seem to want mending; and, lastly, to extirpate the males. I expatiated more largely on these several particulars in our former conversations.

CLAR. Shall we rank their feuds and wars in the number of their toils?

EUGEN. I have formed to myself so noble an idea of what we call labour, that I should be tempted to exclude from the class of toils, all such things as produce nothing but disorder and confusion in the world, as wars for instance. Nevertheless custom, which is the arbiter in languages, having prevailed; since the words *martial toils* are used, when we speak of the wars carried on among mankind; let us also rank the combats of Bees as one of their toils. To give you a full idea, though in the most succinct manner possible, of all that is done in a hive; I must recal to your memory, that the interval of time, between the entrance of one swarm and the issuing out of another, is about six weeks; that eggs are laid daily during this time; that, by the

the hatching of theſe eggs, worms or maggots are produced, all which are fed with the greateſt care and affection; that theſe worms turn to Bees; and that this laying, and theſe perpetual births, multiply the Bees to ſuch a degree, that, becoming too numerous, they, at laſt, are obliged to ſeparate. To this is owing the iſſuing forth of the ſwarms. We are now come to the revolution of that circle which comprehends the whole life of a Bee. You will find me much too prolix, ſhould I begin to entertain you with this ſally; for it is an article which will take up our whole converſation to morrow. But before we part, I will uſe a precaution which may be of ſervice to us when we return hither: I mean, we will examine the ſeveral hives before us; and ſee whether ſome one of them may not be ready to ſend forth a colony, which we generally term breeding of ſwarms. The Bees have had an opportunity of preparing themſelves for this, ſince we began our converſations. Put your ear, Clariſſa, to this hive —— What d'ye hear?

CLAR. A gentle humming. All things ſeem to be in agitation. Is the ſwarm going to iſſue forth. If ſo, I beg we may move off as quick as poſſible; for ſhould the mother Bee alight upon my head, or my ſhoulder, ſhe would draw the whole ſwarm upon me; and I ſhould appear as the Bee-woman, and ſo ſerve (with father Labbat's Bee-man) to make up the pair. But I am no ways ambitious of ſuch a reputation.

EUGEN.

EUGEN. You have nothing to fear from that quarter. It is late, and the ſwarms never iſſue forth at theſe hours. This humming is only an indication that a ſwarm will ſally forth to-morrow. There are ſeveral ſigns which proclaim the approaching departure of a ſwarm. I. When we hear ſuch a humming; and this is uſually heard the evening before their ſally. II. When we perceive drones or males. III. When the hive appears ſo full of Bees, that part of them hang in cluſters; and are heap'd, by thouſands, one upon the other, on the outſide. But the moſt certain ſign, and which proclaims that event to be the very day, is when the Bees forbear flying into the fields, though the ſeaſon ſeems inviting. We will ſee, on the morrow, whether this won't be the caſe, with regard to the hive, where a humming is heard.

CLAR. What means this humming, and the clear and acute ſounds, to which I liſten? Is it a council of war now held by the Bees, to ſettle matters with regard to the ſallying out of the colony?

EUGEN. If we had adher'd to what you ſay, we ſhould have imagin'd one thing only which can be ſuppoſed, though with very great uncertainty. But you are not to doubt but that the romantic ſpirit, which has prevailed among the writers of Bees (Swammerdam, Maraldy, and the author after whom I write, excepted) inſpired them, with regard to theſe ſounds, no leſs than in other matters. Some of them declare, that then the

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new queen harangues the band, the company who are to follow her. Others, that this female-leader animates her subjects with a sort of trumpet, to inspire them with the courage to undertake a mighty and dangerous enterprize. The writer who has succeeded best, in publishing agreeable extravagancies with regard to this humming, is *Charles Butler*, in his Book, intitled the *Female Monarchy*. I will conclude our conversation, by giving you the whimsical commentary made by this author with regard to humming, and hope it will divert you. Butler informs us that, by this noise, one may suppose that the Bee who aspires to be queen, beseeches the queen-mother by sighs and lamentations, to let her conduct a colony out of the hive: that it is sometimes two full days, before the queen can be prevailed upon to be moved by these earnest entreaties; that, when she acquiesces, she answers the petitioner in a stronger and fuller tone of voice; that when the queen-mother has been heard to indulge this request, we may expect a swarm the very next day, in case the weather will permit their issuing forth. In a word, he has fixed the several modulations of the petitioning-bees singing; the different keys of these modulations, and the sounds of which they are composed.

CLAR. I heartily wish, for curiosity sake, that he had pricked down this composition.

EUGEN. He was capable of such a frolic, and I think he has really left us such a specimen. But this is not all. He affirms, that the candi-

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date for the ſovereignty is not permitted to imitate the notes of the reigning queen: Woe to the young female who ſhould preſume to do this, which always proceeds from a ſpirit of rebellion; the criminal being ſentenced to loſe her head, and accordingly falls the immediate victim to the monarch's reſentment. Had the ingenious author of the language of brutes, the peruſal of whoſe work gave you ſo much pleaſure (though you cenſured it juſtly) attempted the explication of this humming, he doubtleſs would have ſaid ſomething more ſatisfactory than Butler.

CLAR. I am perſuaded of this. Nevertheleſs, woe to the man who ſhould attempt to explain the language of brutes, for this is the ſphinx's riddle.

EUGEN. However this be, the humming I hear informs me, that a ſwarm will proceed forth to-morrow. I will now go and take meaſures, in order that you may have due notice of this, leſt you ſhould let ſlip an opportunity which happens ſo very *à propos* to our converſations. I will poſt a centinel, who ſhall give us proper notice.

CLAR. To fill up, uſefully, the time which our return home will take, tell me (by the way) what organ it is by which the Bees utter the ſounds we juſt now heard.

EUGEN. And which you will hear again to-morrow, juſt before the ſwarm ſallies out. Theſe ſounds ariſe from their ſtriking their wings againſt the air; the wings being the ſole organs

of

of their voice ; for, by moving them more or leſs forcibly, and ſwiftly, they beat the air ; and form the varied and confuſed ſounds which we call humming. The Bee who has loſt her wings, or had them cut off, is quite dumb.

CLAR. This is deciſive. Shall we form the ſame judgment with regard to the murmuring noiſe or buzzing, heard by thoſe bees which humm about our ears, when walking in our gardens, or in the fields.

EUGEN. It is exactly the ſame mechaniſm. I don't know one flying inſect that ſends forth ſounds, as other creatures do, from their breaſt.

CLAR. Do you imagine alſo that the graſhopper (cicada) whom *la Fontaine* deſcribes ſo agreeably, chaunting the whole ſummer, ſings only with her wings ?

EUGEN. The *cicada* is an exception to the general Rule. It is true, indeed, that many have likewiſe aſcribed her melody to the ſwift fluttering of her wings, accompanied with the friction of the upper againſt the lower ones. They were induced to ſuppoſe this, from what is found in crickets and ſome other graſhoppers ; but then they were miſtaken. Nature has purpoſely made, for the graſhopper, an organ contriv'd with wonderful Art, on which I may perhaps diſcourſe with you, ſome day or other. — I will only obſerve, that the graſhopper is *ventriloqua*, which ſignifies, that the organ of her voice is in her belly, and not in her breaſt ; that it is a true drum, whoſe ſkin being ſwiftly raiſed or

let

let fall, by a muſcle which moves like a ſpring, ſtrikes the air, and forms the ſound which we honour with the name of harmony or ſinging.

CLAR. May we not ſuppoſe that nature furniſhed the kind mother, after ſhe had taken ſo much pains to produce an inſect, with a little drum to amuſe it during the whole day?

EUGEN. We ought, I preſume, to think more nobly of that mighty artificer, Nature, by aſcribing to her views of a more ſerious and more important kind. Pleaſe to obſerve, that ſhe has indued the males only with the faculty of making this noiſe or cry. Now, it is very probable that he hereby gives the female notice of his preſence; calls her to him; and it is by this means that theſe inſects, who uſually are hid under the leaves of trees, are able to meet.

CONVERSATION XV.

Of the Swarms.

CLARISSA.

DO you think, Eugenio, we ſhall ſoon ſee a ſwarm iſſue forth, and ſettle on our buſhes?

EUGEN. I make no doubt of that, for I perceive, from hence, our centinel who makes a ſignal to us, to advance towards the hive.

CLAR. Let's make haſte then, and not loſe, this lucky Opportunity. Inform me, in the mean time, what are the moſt proper hours and ſeaſons to prompt the ſwarms to iſſue forth.

EUGEN. With regard to the hour, 'tis ſeldom except when the ſun has warm'd the air; that is, from ten or eleven in the morning, till about three in the afternoon. When a hive is over-ſtock'd with Bees, they cauſe a conſiderable heat in it; and if this heat is increas'd by the ſun's darting on the hive; or by ſome hours of hot, ſultry weather; the Bees are not able to ſupport it, they grow faint, and ſo are forced to ſeparate, in order to get air. As to the ſeaſon, this depends on the too great number of young Bees produced. But various ſiniſter accidents, ſeveral of which may ariſe from cold, from wind, or rain, retard the iſſuing forth of a ſwarm. The

ſwarms, in various countries, ſally out in different months; and, in the ſame country, they go out ſooner or later, according as the ſeaſon has been more or leſs favourable. In France, the hives ſeldom emit ſwarms (the ſooneſt) but about the middle of May; and (the lateſt) a little beyond the middle of June.

CLAR. We are now come, and yet the ſwarm is not gone forth. Let's hearken whether our Bees make the ſame humming as yeſterday. Yes, 'tis the very ſame, and, methinks ſtronger.

EUGEN. 'Twill increaſe in this manner continually, 'till the inſtant of their departure.

CLAR. I perceive alſo the truth of what you told me; I mean, that during theſe latter moments, they go very little into the fields, and ſeem to ceaſe from all their toils.

EUGEN. They have done nothing ſince morning. Tho' a ſhining day-break promiſes the Bees a fine day, and fit for getting in a large harveſt of honey, yet very few of them ſtir out all that day, on which the whole nation is to ſeparate.

CLAR. What is the reaſon why thoſe Bees who toil'd yeſterday with ſo much vigour, left their work long before their ſeparation? Were they ſenſible, before day-break, that they ſhould leave this habitation about three in the afternoon? Eight or ten hours is a conſiderable ſpace of time for a Bee. This is ſuppoſing them to foreſee things from far. Do you think they have ſo much foreſight?

EUGEN. What particular can we deny or refuſe a ſet of creatures, who foreſee and provide for the dearth of winter, ſo early as the ſpring?

CLAR. Let us proceed in our ſurvey of, and admiration of them. See what vaſt multitudes croud about the mouth or door; they are all in motion; the diminutive people ſeem in great diſquietude and agitation. I don't doubt but that they are revolving ſomething of mighty importance.

EUGEN. Nothing can certainly be of greater moment to a people, than the reſolution of abandoning their native country, to go and ſettle in a foreign region, and (the worſt circumſtance of all) without knowing to what place they are going, or whether they will be able to meet with a commodious abode.

CLAR. Our ſuperintendant of the hives has taken care of this; he having provided an aſylum for the ſwarm.

EUGEN. If our Bees knew that the ſole motive of our harbouring them, is to get the better opportunity of ſeizing upon their labours, they would not doubt of our kindneſs and benevolence towards them; but being quite in the dark as to this matter, they rely wholly on providence. They always iſſue forth merely at random, or as chance may direct. However they would never once attempt to diſlodge, were they not prompted thereto by their leader, and were not poſſeſs'd of a queen duly qualified to perpetuate the empire they are going to eſtabliſh; for

for tho' the too large number of Bees in a hive, may be a reaſon (among others) which prompts one colony to ſeparate from the reſt, yet this alone is not cauſe ſufficient. I have ſeveral times had hives which were excedingly full of Bees; ſo full, that part of them were forced to keep without, crouded together in form of a ball; and yet the hives in queſtion have produced no ſwarm, for want of their having a queen. Other hives, on the contrary, many parts whereof were empty and unoccupied, have often given me ſwarms. To conclude, 'tis certain that if there is not, in a hive, a young mother qualified to bring forth, (one day) a numerous poſterity; tho' there be ever ſo great a number of Bees, they yet will all ſtay there, and die ſooner than quit the place.

CLAR. Is it poſſible, then, that a queen ſhould forget to lay eggs, whence other queens may ſpring?

EUGEN. 'Tis more probable that this accident ſhould proceed from a natural defect, rather than from forgetfulneſs; it alſo may happen, that the female eggs may be deſtroy'd before they are hatch'd, or the worms before they produced queens. But whatever the cauſe may be, 'tis certain that ſometimes a ſwarm is in want of a queen. I myſelf know this by experience. I have drown'd ſeveral of theſe hives, the ſwarms in which could not be forc'd out by any means; and after examining all the Bees attentively, I ever found that there was but one ſingle mother, and

this the old one; and that there was no new one to lead forth the colony.

CLAR. See! see! our ſwarm is winging away. This ſight, which I never beheld before, is very pleaſing to me. Let's ſtill keep it in view. What a cloud of Bees are there! The air round us is as full of them, as with flakes of ſnow in ſome winter days. Whither are all theſe poor little creatures hurrying? They turn and wind about in the air, doubtleſs to conſider in what place they ſhall alight. Be ſo good as to preſent them a hive, for 'tis a pain to me to ſee them thus in ſuſpenſe.

EUGEN. They would not accept of my offer, I aſſure you. We ſhall do this with better ſucceſs, after they have debated upon a place proper for them to aſſemble in.

CLAR. Is it the queen who makes this choice? Is ſhe at their head?

EUGEN. Chance has a conſiderable ſhare in all this. Let us follow our ſwarm in their march; the Bees themſelves will inſtruct us in what we deſire to know.

CLAR. Hey! why does my gardiner drive them away? Is the man out of his ſenſes? Stop him, I beſeech you.

EUGEN. Let him alone, he knows his buſineſs. When ever the Bees fly too high, as you perceive theſe do, we oblige them to deſcend lower, by throwing up handfuls of ſand or duſt. You ſee that he ſucceeds, and that this ſwarm is alighting.

CLAR.

CLAR. You say true. See yon apple-tree with a bush-head. Part of our Bees are already seated upon it; the rest follow them close, and the assembly grows more numerous every instant.

EUGEN. Let us advance nearer, in order to survey them more accurately. Observe the form in which they lie round the bough in a cluster, and link'd together, as it were, by the legs. Plate X. Fig 3. Lett B.

CLAR. My curiosity extends particularly to the queen. A queen who possesses qualities so becoming her sex, majesty, mildness and fruitfulness, is an object I would love for ever, and could never gaze upon too much. Let us see whether we can find out the queen here. But how will it be possible to do this, among so prodigious a multitude.

EUGEN. Being acquainted with her practices, I'll soon show her to you.——Look here. You'll perceive her alone, on the same bough, and near the swarm. Ibid. Lett. A.

CLAR. You spied her very luckily, for she is this instant entering the groop, and will vanish from us. The other Bees who surrounded her majesty the instant she appeared, have taken her from our sight. The swarm is now very quiet. Will the Bees continue thus any time?

EUGEN. So long as your gardiner, who is now preparing a hive for the reception of these new tenants, may think proper. Before he has finished this expedition, and is ready to receive the Bees in the hive prepared for them, we shall

have time enough to obſerve a great many things with regard to ſwarms.

CLAR. If this be the caſe, be ſo good as to tell me why a braſs pan or kettle was not ſounded, as I have been told is the practice on theſe occaſions. Hence I expected that our Bees would have been entertained with a morning ſerenade.

EUGEN. To inform you of this morning ſerenade, which I look upon as of little uſe, tho' many perſons think it neceſſary; you are to know that hives are commonly ſet in gardens, in order that men may have the better opportunity of looking after them; and that the Bees may, at the ſame time, find flowers, without being forced to fetch them at a great diſtance. Perſons who delight in hives, take great care likewiſe to plant, in the gardens in queſtion, none but dwarf trees, or thoſe with buſhy heads; in order that the ſwarms may not ſettle too high, and may be hiv'd with the greater eaſe. Spite of theſe precautions, the ſwarms frequently wing their flight too high; by which means they would go too far away, and be loſt, in caſe there was not an expedient ready at hand to ſtop them. Two of theſe are very common. The firſt, as you have ſeen, is by throwing up ſand or duſt.

CLAR. I could never have imagin'd, that roving Bees could have been brought back, by throwing ſtones at them.

EUGEN. The particles which fall upon and ſtrike them, induce them to deſcend; and they miſtake them, perhaps, for drops of rain.

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The beſt courſe they can then take (as it may appear to them) is to fly to the aſylum neareſt at hand. The ſecond expedient, which is as much uſed, and of as great antiquity as the other, is to beat on kettles or frying-pans, the moment after the ſwarm is ſet out: but this is not done to give them a ſerenade, nor to congratulate their arrival with a concert. 'Tis affirmed, that this tinkling determines the Bees the ſooner to fix and aſſemble together. Probably what gave riſe to this practice, was its being obſerved that the noiſe of thunder prompts ſuch Bees as are in the fields to return home. But thunder is always accompanied by rain, or threatens it. Now, you know that rain is one of thoſe calamities or plagues which they know how to foreſee and avoid. We therefore may ſuppoſe, that 'tis their dread of the ſtorm, rather than the noiſe, which prompts them to return home when it thunders; for, though we make ever ſo great a noiſe with kettles or pans in calm weather; we don't perceive that ſuch Bees as are on the flowers are terrified by it, or are more eager to return to their hive. Conſequently, the expedient of throwing up ſand to them is the beſt and moſt certain.

CLAR. Is it poſſible that the antients ſhould have let the ſwarms go forth, without embelliſhing this circumſtance with ſome pleaſing fictions? Methinks I have formerly heard of parties detached; of quarter-maſters, ſpies, and I know not what.

EUGEN. This is an incident too ſuſceptible of ornaments to have been forgot by them. Such writers as delighted in relating wonders concerning theſe inſects, declared, that before a ſwarm ventures to leave the hive, ſome of the Bees who are to form it, ſet out upon the diſcovery like ſo many ſpies; and return back to the hive, to give a relation of what they ſaw; and that afterwards, her majeſty's quarter-maſters go and prepare the new habitation. To exhibit the truth hid beneath this fiction: 'Tis not till after the ſwarm is come out of the hive, that ſome of the Bees who compoſe it determine, (by ſurveying the objects round) upon a place proper for them to ſettle in. On this occaſion, the ſagacity for which the Bees are ſo famous, ſeems to fail them on a ſudden. They generally ſettle at firſt, round the bough of a tree; where, being expoſed to the inclemencies of the weather, it would be impoſſible for them to ſubſiſt long.

CLAR. I imagined that they alighted upon a neighbouring tree, merely by way of a half-way-houſe; during which ſome really went in ſearch of a more commodious abode.

EUGEN. Unluckily for their honour, we have but too evident a proof, that they conſider the place where they thus ſettle, as a fixed and permanent reſidence. For, if we leave the Bees five or ſix hours there, we find a little piece of comb already wrought by them. Perhaps, indeed, they might afterwards leave, ſpontaneouſly, a place ſo unſuitable to them; but then they would

would not reſolve upon this, till after proving, to their coſt, that the place is abſolutely not fit for their purpoſe; and this either from their having ſuffered ſo much from heat or cold; or their being tormented by wind and rain.

CLAR. Let us ſeize this favourable opportunity, and examine whether there may not be ſeveral queens in our ſwarm; or a great number of drones.

EUGEN. Your memory, Clariſſa, fails you; a thing which happens very ſeldom. Did I not obſerve to you before, that when a ſwarm divides into two bands or companies (though unequal) 'tis a certain ſign that there are two mothers at leaſt; but that, when they don't divide, this is not an indication that there is but one mother only. Several may be ſo conſtantly hid under this heap of inſects, as to be quite taken from our ſight. With regard to males, you may ſee that they are pretty numerous here.

CLAR. I perceive them. To compenſate for my defect of memory, by ſome act of judgment, I'll now propoſe a thing which came into my head, when you ſpoke about thoſe orphan-ſwarms, who chuſe to die in their native abode, rather than diſlodge from it when there is no mother to head them. Is there no poſſibility of ſaving them?

EUGEN. This doubtleſs would be a moſt excellent ſecret, and of the higheſt advantage to us. The ſaving of a whole ſwarm is a thing too

profi-

profitable for us to neglect. But pray now, what is the expedient?

CLAR. I would supply them with one of those supernumerary mothers whom I should meet with in another hive, and was sentenced to die. The saving the life of a queen who has no subjects, and of subjects who have no queen, each whereof would perish separately; and then unite them in one family, in order to perpetuate their kind, appears to me a noble and very laudable action; 'tis a secret I am highly delighted with myself for having found; and I heartily wish it may appear in as favourable a light to you.

EUGEN. I greatly approve your hint; and think it certainly deserves to be attempted more successfully than I have yet been able to do.

CLAR. How! did you think of this before me! Must I always meet with persons in my way, who will bereave me of the honour of being the first who started a thought?

EUGEN. I have not executed this to so much advantage as you propose it. However, I intend to do it the first opportunity; and am persuaded it would be attempted with success, in case the requisite precautions were used. The manner in which I proceeded was this: you are now so well acquainted with every thing of this kind, that you'll easily find out the reason why I failed in my experiment. I took a basket-hive, which had been so populous for several weeks, that part of its Bees were reduced to the necessity of standing

ing abroad night and day, there expoſed to all the rigours of the weather. But notwithſtanding this, no ſwarm appeared, whence I judged that they were in want of a female. I was very curious to enquire what would happen on this occaſion, in caſe I ſhould introduce one that was an alien, and fit to lay; and accordingly the mother of a hive, whence I had had three ſwarms, was employed for this purpoſe. I now plunged the whole hive in queſtion into the water, and thence drew the mother almoſt motionleſs and dead. I then painted her corſlet or breaſt with a little red varniſh, in order to know her again; and after having dried, warmed, and reſtored this queen to her former vigour, I carried her one morning and put her under this baſket-hive, which could not hold all the Bees, and whence no ſwarm had yet gone forth. In an inſtant ſhe was covered by ſuch a multitude of Bees, that I quite loſt ſight of her; and I preſumed that ſhe was favourably received, ſince no ſenſible tumult was occaſioned. In the evening, I ſtooped the baſket, to ſee whether I ſhould find this new-mother, and what ſort of figure ſhe would then make. Accordingly I perceived her. She was among a cluſter of our Bees, inſtead of being within the hive; when taking up a bit of ſtraw, I ſeparated the queen from her cluſter, and ſet her down upon the ſtand of the hive, but ſhe ſoon left it, and mixed with other Bees. She then diſappeared, and I put the hive in its natural poſition. Returning next morning, to ſee the effect of my experiment, I

found that the mother whose breast I had painted red, was dead. She had been conveyed, by those Bees who carry off the dead, to some distance, and opposite to the hive. You will enquire, how it came to pass, that so fruitful a mother had not been spared; especially at a time when one would have concluded that she must be dear and precious to Bees, who waited impatiently for a queen to head them, from an abode, which no ways suited them. Let us be so ingenuous as to confess, that we are not yet sufficiently acquainted with the principles on which the Bees act.

CLAR. True philosophers only can stop their career on the confines of a conjecture; but we ignorant women, take the liberty to blab our opinions freely. We even have not yet knowledge enough, to be sensible how little we really know. I'll give you then my opinion with regard to your experiment. It might have failed; first, because you had half-drowned your fruitful mother; you had perhaps given her too strong a dose of water, a circumstance which might have altered her present constitution; and disabled her from laying, which the Working-Bees possibly discovered. Secondly, you observed that this Bee had before sent forth three swarms. May we not suppose that the Working-bees, being well skilled in those characteristics which denote fruitful mothers, might have rejected the mother in question, as being too much worn out for her ever to give birth to a numerous colony? I grant you that she was favourably received, at first; but I am of

opinion that, upon being better examined, and afterwards ſearched by the knowing Working-bees, ſhe was put to death as an impoſtor, who intended to deceive, and promiſed more than ſhe could perform. Take a young mother who has not laid, (or very little) and your experiment may turn out to greater advantage.

EUGEN. All this may be ſuppoſed. We may alſo imagine, with equal probability, that the death of this alien-mother was occaſioned by the reigning-mother, who, for reaſons of ſtate, might be induced to reſolve the death of her rival. Be this as it will, your conjectures appear ſo juſt, that I promiſe to pay a regard to them, the firſt time I repeat my experiment. For I am perſuaded that Bees, when in want of a fruitful mother, will be ever ready to receive one who ſhould be well qualified for their purpoſe, whether of their own family or an alien. You'll be as firmly perſuaded, as I can be, of the probability of this; after I ſhall have informed you of another experiment made by me, that had the wiſhed-for ſucceſs, and which may ſerve as a ſupplement to the preceeding one. This will prove to you, that not only the preſence of an alien-mother will ſuffice to orphan Bees, in lieu of a true mother; but even that the hopes (and this alone) of ſoon ſeeing a mother born among themſelves, will induce them to fall to work again. I one day placed, in a ſmall hive, a piece of a comb taken out of another hive, where the Bees were at high-work. In this piece of comb were royal

cells

cells, ſhut up, which conſequently contained *nymphæ*, who were to become mothers. I afterwards put into this hive, above a thouſand or fifteen hundred Working-bees, and twenty males, or thereabouts. Theſe Bees, who would not have done a ſtroke of work, (in caſe no mother being among them, they alſo had been without hopes of obtaining one) were firmly reſolved to labour, merely upon ſeeing a royal cell clos'd up. They, indeed, worked but very ſlowly during the two or three firſt days. Among mankind, hope is vigilant and active, and poſſeſſion flat and languid; but 'tis the very reverſe as to Bees. They began ſlowly, but the ſucceeding days they proceeded very ſtrenuouſly in their labours, whence I concluded that a mother was born among them. This being duly enquired into, a mother was diſcovered, who yet was an alien.

CLAR. Nothing can be more convincing than this experiment. To proceed now to other matters. I ſee that our ſwarm muſt have been formed of a prodigious number of Bees, they dragging down the bough on which they are cluſter'd. I ſhould be glad to know how much this aſſemblage of Bees may weigh.

Plate X. Fig. 3. Lett. B.

EUGEN. That I am able to tell you. But as I perceive your gardiner is going to take the ſwarm, ſuſpend your curioſity a little, till ſuch time as you ſhall have ſeen his operation. I'll firſt inform you of the ſeveral preparations he has juſt now made, to make the hive fit for the reception of his gueſts. In the firſt place, he cleaned

cleaned it with the utmoſt care. He afterwards rubbed the inward partitions carefully with herbs or flowers, the fragrance of which is grateful to the little tenants. I ſaw from hence that 'twas balm. Bean-flowers are likewiſe employed to very good purpoſe on this occaſion. Another thing which I think of uſe, and of as much benefit as the pleaſing their ſmell, is to gratify their taſte; by rubbing ſome parts of the inſides of the hive, with matter which may be agreeable to them, as honey, cream, &c. Precautions of this kind cannot be of prejudice, but I don't think them eſſentially neceſſary. Every thing has ſucceeded perfectly to my wiſhes, in the like circumſtances, though I did not make uſe of them. Obſerve, now, the manner in which your gardiner goes to work, in order to hive the Bees.

CLAR. The old man was very much in the right, in arming his head with a kind of helmet; in covering his face with a gauze maſk, and his hands with a ſtout pair of gloves.

EUGEN. I yet have ſeen peaſants, in their ſhirts, perform this operation with their naked hands and face.

CLAR. Thoſe who firſt attempted this muſt have been not a little bold. With regard to my gardiner, he is not only of a contrary diſpoſition, but ſeems to me ſomething clumſey; he not managing his little broom dexterouſly, whereby all the Bees don't fall into his baſket. I perceive that large cluſters of them are fallen to the ground, and many others are flying away.

EUGEN.

EUGEN. 'Tis enough that a conſiderable part enter it, and ſtay there; be aſſured that the reſt will ſoon follow. See, the operation is ended; and the hive is fixed on its ſtand with the Bees in it.

CLAR. I perceive that thoſe who fell to the ground, take their way towards the hive; and that ſuch as had winged their flight aloft, and were gone aſtray, haſten to rejoin their companions. Nevertheleſs, many of them return to the bough whence they were taken, and where they were ſo diſadvantageouſly ſettled.

EUGEN. Theſe would do more; they would continue there, and return hither ſo often as they ſhould be drove away, if care was not taken to oblige them to quit it; by rubbing this bough with leaves whoſe ſmell is diſtaſteful to them, ſuch as thoſe of the elder-tree and rue; or elſe to force them thence, with the ſmoak of burning linnen.

CLAR. Of what uſe are thoſe four ſtakes which old James fixes about the hive?

EUGEN. This is a precaution abſolutely neceſſary. When a hive has been filled with new Bees, the baſket is not carried away immediately, and ſet in its place with the reſt; but 'tis left, till the evening, in the ſame place where the ſwarm was hived; when, in caſe the tree at whoſe foot they were taken in does not project ſhade enough; and the ſun-beams are exceedingly hot, as at this inſtant; then make, with four ſtakes and a cloth, a kind of tent which ſcreens the Bees from the exceſſive

exceſſive heat; or elſe employ tufted boughs of trees. The hive is ſerved in this manner till after ſun-ſet, when it is conveyed gently to a ſtand allotted for it, and on which it is to be fixed.

CLAR. I would gladly know what my gardiner would have done, had our ſwarm, inſtead of fixing on yon dwarf-tree with a buſhy head, flown and alighted on one of thoſe lofty trees, ſtanding at the end of my kitchen-garden.

EUGEN. This is an inconveniency to which the induſtry of man muſt apply the beſt remedy in his power. Some ſwarms fly and ſettle on little boughs of very lofty trees; and this is the worſt ſituation they could poſſibly be in with regard to us. Different expedients muſt be uſed, according to the ſhape or figure of the tree, the diſpoſition of its boughs, and its height. The good ſenſe of the perſon who would willingly ſave his ſwarm, muſt ſuggeſt to him methods for doing this. If the tree upon which they are ſettled is not vaſtly high, a man may go up a ladder ſet againſt the trunk of the tree; when holding the hive turned topſy-turvy under the ſwarm; another perſon, who had climbed up the ſame tree, may drive the Bees, with a broom of a proper length, into the hive. In caſe the ſwarm is too near the extremity of the boughs, and in ſuch a manner that the ladder cannot be fixed againſt it; the hive (turned as above) muſt be lifted up by means of a long, ſtout pole, till it be pretty near to the ſwarm; after which the Bees muſt be drove into it with a long broom.

Several other expedients may be uſed, as circumſtances may require: but there is one which ſeemed to me the ſimpleſt and moſt commodious on many ſuch occaſions: and this is, to wait till the ſun is ſet, and the Bees are, by the cool of the evening, become leſs animated and furious. In this caſe, the bough of the tree is ſawed off gently; when being let down carefully, and the ſwarm upon it, they are eaſily hived by this means.

CLAR. Does it never happen that the Bees tremble, the inſtant of their departure, at the boldneſs of their enterprize? do they never ſhudder at the ſight of the wide-extended ocean of air in which they plunge? and are their boſoms never fired with a deſire to return to their native country, as did the companions of Chriſtopher Columbus?

EUGEN. We frequently perceive emotions of fear and dread, but none of repentance, in animals. Their reſolutions are fixed, carried on, and never checked by after-reflexions; and they never draw back, except when they meet with ſuch obſtacles as appear to them inſurmountable. We ſometimes find that Bees, after leaving the hive in a ſwarm; and their being diſperſed in the air, or aſſembled on a tree, return to their firſt abode; but this never happens, except when the young queen, who ſtood at the door, and was ready to accompany them, did not follow; and this for want of ſtrength, or perhaps boldneſs enough to truſt to her wings for the

the firſt time. Poſſibly too a young mother may perceive that ſhe is come forth unimpregnated; a circumſtance which will prompt her to return to the hive; and the ſeveral Working-Bees, her dependants, to go back with her.

CLAR. I muſt put you in mind of the promiſe you made me, I mean to tell me how much a ſwarm weighs.

EUGEN. I am now able to gratify your curioſity in that particular. All you need do, for this purpoſe, is to liſten patiently, whilſt I acquaint you with the particulars of an experiment which informed me of what you deſire to know. A hive of mine produced me, on a certain day, one of the largeſt ſwarms I had ever then ſeen. This ſwarm went and ſettled ſo very ſeaſonably on the extremity of a bough of one of the trees in my garden, that I took the opportunity I then had, to weigh it with eaſe. All the Bees were aſſembled in ſuch a manner, that their whole maſs was ſhaped like a long pyramid, two foot high; and that hid every part of the bough round which they were cluſter'd. The Bees were ſo very numerous, that I was afraid the bough would break; for which reaſon I propped it with a forked pole, in the ſame manner as boughs over-loaded with fruit; notwithſtanding which, it bowed ſo low, that it was within two inches of the ground. To find out the weight of them, I bound the bough pretty near the upper-part of the ſwarm; and the packthread employed for this purpoſe terminated in a bow or loop-hole. Our matters be-

ing thus prepared, I ordered a man to come forward, who thruſt his ſteel-yards (for weighing) into the loop-hole of the packthread; and whilſt he raiſed a little the bough, by drawing the ſteel-yards upwards, others cut it above the place where the ligature had been made; but all this gently, and without diſturbing the ſwarm; by which means the bough and the ſwarm being thus ſeparated from the tree, remained ſuſpended to the ſteel-yards. I then eaſily found, that my ſwarm weighed eight pounds.

CLAR. You mean, branch and all.

EUGEN. You are very accurate, and won't let the moſt minute thing eſcape you. I'll now anſwer you. After having hived all theſe Bees, I weighed the bough ſeparately, and found it to be ſix ounces. However, I won't ſubſtract theſe from the eight pounds; I having wherewithal (and over and above) to compenſate for this. Though the ſwarm in queſtion was very large, yet all the Bees belonging to it were not yet ſettled upon the bough. Several little cluſters of them lay upon the ground, whilſt others were in the air; and none of theſe would join the great cluſter or aſſemblage, though I had given them time to do it. Theſe ſeveral parts diſperſed were equal, at leaſt, to the weight of the bough. We thene may conclude (and that without overrating) that the Bees weighed eight pounds. But, unluckily for us, all ſwarms are not ſo ponderous. They uſually are of all weights under the

the above-mentioned; and I have met with a ſwarm which did not weigh above a pound.

CLAR. Since you thus calculate and weigh every thing in nature, you doubtleſs will be able to inform me, how many Bees are contain'd in eight pounds of theſe inſects.

EUGEN. You ſmile in putting this queſtion to me, as though you imagin'd you had deſired me to count the number of ſands in the ocean.

CLAR. I really concluded, that ſuch a calculation would take up a long time.

EUGEN. This may be diſcovered by a very ſhort method, which I employ'd. I put, into a ſcale, a half-ounce weight; and, in the other ſcale, as many Bees as made the *equilibrium*. You will ſuppoſe that I was obliged to employ dead Bees for this purpoſe. I muſt obſerve, by the way, that theſe were Bees who had been killed in a dreadful battle; occaſioned by a band of aliens, who endeavoured to ſeize upon a peopled hive. One hundred and ſixty eight of theſe dead Bees weighed but half an ounce. There conſequently are twice an hundred and ſixty eight Bees in an ounce, that is, three hundred and thirty ſix. Now, if three hundred and thirty ſix Bees weigh an ounce, there muſt be five thouſand three hundred and ſixty ſix in ſixteen ounces or a pound; and conſequently forty three thouſand eight hundred Bees to weigh eight pounds. To avoid all ſuſpicion of error in our calculation, we'll reduce the number of our Bees to forty thouſand. This ſtill will be a good

handſome quantity; and more conſiderable than that of the inhabitants of many great cities. I muſt nevertheleſs confeſs, with regard to this hive of eight pounds, that many more Bees ſeemed to have gone forth from it, compar'd to the number who continued in it; that they were not all of the new brood, but that many of them were of the former one.

CLAR. Do you think this ſort of ſwarms better than the leſs numerous ones?

EUGEN. I don't look upon them as the beſt. The ſwarm I am ſpeaking of did not do me the ſervice I expected. There were ſo great a number of drones among them, that they could not be all deſtroy'd during the ſummer. Some remained, who ſurvived the whole winter; and theſe, in all probability, perplex'd the working Bees to ſuch a degree, that this hive was abandon'd in ſpring. I ſhould rather chuſe a ſwarm weighing five or ſix pounds. Butler, who does not always give into romance, informs us that an excellent ſwarm weighs ſix pounds Engliſh, a good one five pounds, and a tolerable good one, four.

CLAR. What! did Butler alſo weigh ſwarms?

EUGEN. He does not tell us how he weighed them; but there is a very eaſy method which I will teach your gardiner, in order that he, being well ſkill'd in ſwarms, may be able to diſtinguiſh between ſuch as are fit for coupling, or mixing together; and thoſe which ought to be weaken'd.

CLAR.

CLAR. Teach me this method likewiſe, for I would not willingly have my gardiner more knowing than myſelf.

EUGEN. Emulation is a laudable principle. You know that we uſually leave, at the top of the baſket, a ſmall wooden pin or peg, or a tuft of ſtraw, by which we take or hold up the hives. Now, if a ring, either of iron or cord, was added, this would give us an opportunity of weighing the ſeveral ſwarms which theſe baſkets were to lodge, before we introduc'd a new one into them. But when every thing is prepared for this purpoſe, we muſt weigh the empty hive, and afterwards turn the Bees into it. In the evening, when they are all come back from the fields, and benumm'd as it were with cold, we muſt weigh it a ſecond time. You conceive that the ſurplus of its then weight, will be that of the Bees which were introduc'd into it; and hence you'll eſtimate the ſwarm, and know what muſt be done with it.

CLAR. I frequently obſerve, and perceive with pleaſure, that your weights, your meaſures, and calculations, are not mere uſeleſs curioſities.

EUGEN. Some continue to be ſuch, which yet will be otherwiſe to our ſucceſſors, who will make them of ſervice.

CLAR. I don't perceive that any of our Bees newly lodg'd go forth from the hive, and wing their way into the fields. Is this repoſe and

tranquillity an indication that they are going to abandon it?

EUGEN. When a ſwarm of Bees are pleaſed with a new tenanted-hive, they are not long unactive. Though all the Bees in it ſeem to be at reſt and idle, and not one of them leaves it and flies into the fields, yet ſome are working at combs. We often don't perceive, till after the Bees have made pieces half a foot or a foot long, and ſeveral inches broad, that many of theſe inſects which were ſuppoſed quite idle, had toil'd very hard; or rather, that they all work'd in their turns; a circumſtance which proves that, at their quitting the former hive, they carried a proviſion of prepared wax in their ſtomachs. One ſign that Bees are pleaſed with the hive they are put into is, when they aſcend as high therein as they can, which is an indication that they deſign to fix there; this being the part where they uſually build their firſt cells, and lay the foundations of their edifices.

CLAR. Will the ſwarm we have now ſeen hiv'd, produce another ſwarm this year?

EUGEN. Sometimes the ſwarms which appear early produce a ſecond generation. However, they commonly don't give birth to a new ſwarm till the enſuing year.

CLAR. I beg my queſtions may not tire you. How many ſwarms proceed from a good hive in one year?

EUGEN. Three, four, and ſometimes five ſwarms iſſue from the ſame hive, one after the other;

other ; in the interval of five, ſix, and ſometimes ten or twelve days.

CLAR. What do you mean by coupling or mixing ſwarms ? What precautions muſt be uſed, in order to make them proſper ?

EUGEN. The clearing up of theſe matters depends on the knowledge of ſeveral previous circumſtances; and theſe will be the ſubject of our future converſations, in which I ſhall treat of the enemies to the Bees, their ſickneſſes ; and the expedients that muſt be uſed, as well to remove whatever may annoy them, as to procure them the ſeveral neceſſaries.

CLAR. The particulars of this knowledge, relating to the practice, will be more agreeable to me than the theory, or what relates only to the hiſtory of the Bees.

CON-

CONVERSATION XVI.

Of the enemies to the Bees, and ſuch inſects as devour the wax.

CLARISSA.

I Am not ſurprized that Bees ſhould have enemies. As they poſſeſs riches, this circumſtance alone muſt be motive ſufficient. Are not we ourſelves their enemies, though concealed beneath the maſk of friendſhip? In caſe we could not poſſeſs ourſelves of their treaſures, any otherwiſe than by killing them, ſhould we ſcruple an inſtant to do this?

EUGEN. We are ſo far from ſcrupling it, that we daily put them to death very inhumanly, and without any manner of neceſſity. I cannot forbear reproaching, for this cruel treatment, the perſons who breed Bees.

CLAR. I am not ſurpriz'd at it. Theſe little creatures are laborious; they perform ſuch works as it is not in our power to execute, but which are for our purpoſe. This is enough for us: whether dead or alive, we muſt plunder their works. We treat them juſt as we uſe one another. The huſbandman ſows, reaps and gathers in; at the laſt mentioned ſeaſon, what numbers

numbers of idle people come and ſhare with him in the fruits of his toil!

EUGEN. On which ſide ſoever we caſt our eyes, we ſhall ſee nothing but wolves and ſheep. The Bees have more than one enemy. Among the many that might be named, man is, indeed, the moſt barbarous. I will not particularize, in this day's converſation, his cruelty with regard to our ingenious inſects; we will now diſcourſe on thoſe creatures only, whom a power, unknown to themſelves, forces to be enemies to the Bees.

CLAR. I will know them, whoever they be; and, if poſſible, make the life of Bees (my favourites) more eaſy and comfortable, and leſs expoſed to perſecution. I now am ready to defend them againſt all oppoſers, and ſhall look upon their enemies as mine. Point them out to me, let me get acquainted with them, and I will purſue them for ever.

EUGEN. D'ye ſee the ſparrow on yon plumb-tree? He is one of their enemies. This wretch laughs at your threats; and is preparing to devour the little creatures, to whom you indulge your protection, and are ſo fond of?

CLAR. Ha! that is an enemy I ſhan't run after, but muſt deſire you to rid me of him.

EUGEN. Had we but one ſparrow to oppoſe, our hive would ſoon be very ſecure: but there are ſuch prodigious multitudes of theſe devourers of Bees; (not to mention the many enemies, of other kinds, who infeſt them) that we had better paſs this day in enquiring who they

are, and try whether we can't leſſen their number; for, as to the deſtroying of them all, that would be impoſſible. The enemies to the Bees are of three ſorts. The firſt are weak, heedleſs inſects, who creep into a hive without knowing whither they are going; and only raiſe diſturbances and confuſion therein. The ſecond endeavours to deſtroy the Bees, and eat up their honey; and the malice of the third kind is levell'd only at their wax. In the firſt claſs we may rank ſuch ſlugs and ſnails as creep heavily into hives; beetles, foreign or wild Bees, who go in queſt of works ready form'd to their hands. Theſe kinds of enemies are eaſily deſtroy'd.

CLAR. I imagine that we need not be under any concern about them; and that our Bees have weapons ſufficient to defend themſelves againſt their attacks.

EUGEN. The ſecond claſs includes the ſparrow you juſt now obſerved, and all ſuch as reſemble him. I have often ſeen, with the utmoſt uneaſineſs, a parcel of ſparrows flock round my hives, and who, ſpite of my preſence, peck'd and gobbled down the Bees, as tho' they had been ſo many ears of corn. No bird makes ſuch dreadful havock among our inſects as the ſparrow, he deſtroying greater numbers of them than all the other birds put together.

CLAR. I imagine that ſwallows muſt likewiſe be terrible devourers of Bees.

EUGEN. Tho' they are ſaid to feed greedily upon our inſects, I yet am of opinion that they take

take them but ſeldom, any more than toads, lizzards, or frogs; tho' ſome writers, among the antients, adviſe their being drove from the hive. But 'tis otherwiſe with regard to another kind of inſects, which, tho' of a ſpecies related to our Bees, are yet vaſtly formidable to them: I mean hornets and waſps; and even waſps of the moſt common ſort, ſuch as are ſcarce larger in ſize, than our inſects. I have often ſeen ſome of theſe wind round and round a hive; watching for a favourable opportunity to attack a laborious Bee, when returning from the fields tir'd, and loaded with wax. The Bee, tho' arm'd with a ſting ſo fatal to man, endeavour'd, but in vain, to defend herſelf againſt a waſp, who kill'd her in a moment. I have ſometimes ſeen a waſp fly off with her prey; ſometimes ſhe, immediately after butchering her enemy, tore open her belly, and ſuck'd the whole contents of it. I have even ſeen Bees, whilſt buſied in ſipping the nectar on flowers, or winging their way to them, carried off inſtantly by hornets or waſps; in like manner as an innocent turtle-dove is ſeiz'd by a hawk or other rapacious bird.

CLAR. This is dreadful. How is it poſſible that even one of our inſects ſhould be left in the world? For I imagine that there are as great numbers, at leaſt, of hornets and waſps, as of Bees. Should a whole claſs devour the other, the entire race of one or other of them muſt ſoon be extinct.

EUGEN.

EUGEN. Nature, at the ſame time that ſhe permitted ſuch maſſacres, has preſcribed limits to them. Studious to preſerve the particular kinds form'd by her, ſhe has prevented their entire annihilation, as well as their too great increaſe. Were the hornets and waſps to come armed, in a body, and attack a hive, the tenants of it would doubtleſs be deſtroy'd in a moment; but they never do this. Waſps, like all other thieves and murtherers, are errant cowards; and knowing that the Bees are able to defend themſelves, they never attack them except when they have an advantageous opportunity for ſo doing. The war wag'd againſt them is wholly by ſurprize, and merely, what we term plundering, or making incurſions. And, indeed, this is of no very fatal conſequence; and my opinion is, that it would not be worth while for us to endeavour to deſtroy all the waſps neſts in a country, as ſome authors, who were fond of Bees, have taught us.

CLAR. Thus I find that hornets and waſps are, with regard to Bees, what lions and tygers are to men. They now and then happen to ſeize and devour one of our ſpecies; but this is done ſo ſeldom, that there is no occaſion that the whole world ſhould take up arms, merely to extirpate the race of them. Men muſt make the beſt defence they can. Let us return, and enquire upon what principle it is, that waſps make war upon our hives. Is it from a paſſion for ſlaughter? Is

it

it from a jealouſy with regard to merit, or the labours in which they are reſpectively concern'd?

EUGEN. From none of theſe, but from thoſe principles which, among mankind, give riſe to cut-throat thieves, I mean gluttony and idleneſs. The waſp, as well as the hornet, is very ſenſible that the Bee carries in her body, a portion of wrought honey. Now whenever the ruffian finds an opportunity of ſeizing, without any hazard to himſelf, a Bee, he ruſhes upon her, rips up her belly inſtantly, and ſucks her bowels for a dainty he otherwiſe would have been forced to go in queſt of at a diſtance, at the bottom of the cups of flowers.

CLAR. Let us talk no more of theſe enemies; they make my blood run cold. I'll certainly deſtroy all that ever come in my way. What think you of ſpiders?

EUGEN. I fancy that theſe make but very little deſtruction among our Bees. The ſpider is, in general, a creature whoſe chief occupation is to ſpread her nets; and who ſubſiſts entirely on what fortune happens to throw in her way. She does not go forth in queſt of prey, which muſt come to her; beſides, ſo great is her temperance, that ſhe is contented with a little. Her only food is a few gnats, or other diminutive game, which fall into her ſnares. But for prey of a conſiderable ſize, (ſuch as a Bee) this ſhe rarely meets with, and therefore is to be very little regarded. We likewiſe muſt not rank ants among the enemies to our inſects; tho' ſome authors declare them

them to be vaſtly bad neighbours to hives. But ſo far from this, I'll preſently ſhow you that Bees and ants live very friendly as neighbours, and are well enough pleas'd with one another. The ant, tho' ſo fond of ſweet things, can better reſtrain her appetite than man; and will inhabit cloſe by the forbidden fruit without once touching it. I had a glaſs hive, whoſe ſhutters I did not open for ſome time. During this interval, certain ants obſerved that there was a void ſpace between the ſhutters, and the panes of glaſs of my hive; and preſently concluded that this would be a very good abode for themſelves, and much more healthy and commodious than any other they could make choice of; ſince they would always have a conſtant degree of heat there, ſuch as was not to be met with in any other part of the garden. Accordingly they inſtantly convey'd thither their eggs, their *nymphæ*, and their worms, and fixed upon this as their reſidence. Ants were without the hive, and Bees within; a ſingle glaſs only ſeparating two nations, ſo different in manners, in cuſtoms and genius. The Bees were abundantly provided with a dainty of which ants are exceedingly fond, I mean honey. The ants had juſt reaſon to be apprehenſive that the Bees would be uneaſy, and jealous to preſerve ſo precious a treaſure. Nevertheleſs, the utmoſt harmony and concord prevail'd between the two nations. Not a ſingle ant was tempted to enter the hive, how ſtrongly ſoever ſhe might be invited by the fragrancy of the honey; nor did any Bee diſturb

the ants, tho' infinitely ſuperior to them in power, the ſeveral individuals, on each ſide, went in and out peaceably: they would meet in the way, without fearing or moleſting one another: reſpect on one ſide, and complacency on the other, were the foundation of this peace.

CLAR. How delightful is ſuch an union! Why do not men live in as friendly a manner? But is not this double hive a ſingular caſe, a kind of tranſient phænomenon which has never appeared ſince?

EUGEN. This is not a phænomenon, 'tis a real thing, which I myſelf have often ſeen and admired. We may, indeed, aſcribe the modeſty and prudence of the ants to fear. They ſeem ſenſible of the danger to which they would expoſe themſelves, ſhould they be tempted to plunder the honey of a very populous hive. After leaving, during ſome hours, hives whoſe Bees were dead; I obſerv'd that then the ants, having nothing to dread, went and fed upon the honey left in it.

CLAR. The ſame thing is ſeen among mankind. More of theſe are made wiſe, through fear and weakneſs, than from reaſon. Thus I find that you exclude, from the number of enemies to Bees, the ſpider and the ant. This pleaſes me, and my fears for my darling inſects are leſſen'd in proportion. Do any other creatures endeavour to maſſacre them?

EUGEN. I know three, the moſt formidable whereof is man himſelf, who, from a very in-

judicious intereſt, is often the greateſt deſtroyer of them. I'll treat more largely of this, when we come to diſcourſe concerning the beſt manner of managing hives. The ſecond enemy is the field-mouſe, concerning whom I ſhall ſpeak no farther at preſent; becauſe, as this enemy to the Bees never appears except in winter; I'll poſtpone what I have to ſay with regard to this animal, 'till I obſerve how Bees are to be managed during the rigorous ſeaſon of the year. I proceed to the third enemy, who is a little inſect that ſettles upon the Bee, and lives by ſucking her. This is properly the vermin (fleas or lice) of the Bees. 'Tis a ſort of reddiſh louſe, about the ſize of a very ſmall pin's head. Its body is ſhining and ſcaly, as likewiſe its ſix legs. It has not any part ſhap'd like a true head, the foremoſt end of this ſeeming to be cut ſquare-wiſe. 'Tis almoſt always found ſticking to the Bee's breaſt. However, I have frequently met with it near the Bees neck; in that part where the wings begin, and ſometimes near that of one of the legs. This inſect has a trunk, which, I believe, cannot pierce through the ſcales wherewith the Bee's breaſt is arm'd; but then ſhe may thruſt it into the joints, which being neceſſarily flexible, conſequently no ſcales could be in that part. The young Bees are never incommoded by theſe vermin, which prey upon none but the old Bees, all of whom have never more than one upon them.

Plate XI. Fig. 5.

Plate XI. Fig. 6.

CLAR. In what manner does this vermin prejudice hives?

EUGEN.

EUGEN. The hives whoſe Bees are peſter'd with them, are not thought ſo well of as others, and perhaps with reaſon; becauſe theſe lice are oftner found upon the Bees that inhabit old hives, (where they have had time to multiply) than upon the tenants of new ones. But I am not able to ſay, whether they really do great injury to Bees. However, I am almoſt ſure that they don't put them to much pain, and incommode them but very little; the Bees ſcarce ever endeavouring to ſhake them off from certain parts of their body, on which they fix themſelves; and whence they might eaſily diſlodge them with their legs. We are told of various remedies to deſtroy this ſort of vermin; but I give little credit to them. As therefore I take this diſeaſe to be of little conſequence, and the cure of it very doubtful, I'll wave all further enquiry concerning it. I'll now diſcourſe upon a much more dangerous enemy; his malice being levell'd not only againſt the Bees, (he endeavouring to deſtroy, devour and overthrow all their works) but likewiſe againſt mankind; he bereaving us of the hopes of dividing, with the Bees, a delicious food which we conſider as common between them and us. This enemy, ſingly, compoſes the third claſs; and 'tis he who plunders the wax. Was I to inform you of the ſeveral particulars I know concerning him, you might think me very tedious. You ſurely would not have me ſuſpend the principal hiſtory for the ſake of entertaining you, a long time, with a ſubject that was merely the acceſſory?

CLAR. 'Tis ſtill the hiſtory of nature. On what ſubjects ſoever its wonders are exhibited, I ſhall be greatly delighted to ſee and hear them.

EUGEN. Since you are ſo diſpoſed, the concluſion of this day's converſation, ſhall be the hiſtory of this laſt enemy (at leaſt that I am acquainted with) to the Bees. I mean thoſe worms or moths who feed upon wax. Would you be apt to give credit to a perſon who ſhould affirm, that there is a country where ten or twelve ſheep, can hunt and drive away more than eighteen thouſand wolves, and force them to quit the place?

CLAR. This would ſeem quite a paradox.

EUGEN. And yet this country, where ſo extraordinary a circumſtance is found, is now under your eye: 'tis a hive. If we ſubſtitute Bees inſtead of wolves; and a ſort of ſmall caterpillar, (which I will ſhow you) in the place of ſheep, 'twill be no longer a paradox, and my aſſertion will be found literally true. The inſect, term'd the *wax-worm* or *wax-moth*, becauſe of the havock made by her in wax, is a diminutive caterpillar; tender and delicate in its frame, unarm'd and defenceleſs; an inſect who can ſubſiſt itſelf in the midſt, and at the coſt, of the moſt populous hive; a tiny creature, who feeds upon the labours of above eighteen thouſand Bees, defended with breaſt plates, and arm'd with murthering weapons; which they are ever ready to employ againſt all who annoy, or attempt to annoy them; and who guard perpetually their treaſure.

treaſure. You, poſſibly, may diſcover too ſoon, and with the greateſt regret, that ten or twelve, and often a leſs number of theſe little catapillars, have bor'd through, deſtroy'd, and broke to pieces, the honey-combs of one of your hives; and that, on the ruins of the cells, (ſpite of the formidable army ſurrounding them) thoſe weak enemies ſhall have thrown up new edifices for lodging themſelves; ſhall have built them with the ruins of the cells; and will, at laſt, force the Bees to quit the place, in order for them to reſide in it.

CLAR. This ſhows evidently, that there is no ſuch thing as an impotent enemy; and that thoſe perſons are very weak who cry, what prejudice can ſuch a man do me? Induſtry will find out many more methods to hurt, than ſtrength can ſuggeſt. The inſect you ſpeak of, muſt be endued with a very ſurprizing talent; in being able to compenſate (by induſtry) for this weakneſs, and to overcome ſuch mighty obſtacles. The particulars you now relate, make me exceedingly deſirous of getting acquainted with ſo ſingular a creature.

EUGEN. We call, by the general term *Moth*, all thoſe little worms, moſt of which are caterpillars, who prey upon our clothes, furniture, hangings, wood, books, *&c.* Among theſe creatures, ſome cut themſelves out clothes, which they put on, walk with them, and live under them, the whole time that they continue in the ſtate of worms or caterpillars. Others, whom

nature has not taught to make portable dreſſes, have the art to make themſelves galleries, which ſerve them, at one and the ſame time, for clothes and houſes. The former are call'd by authors, *Moths*, and the others, *falſe Moths*. Both of them owe their exiſtence to *Papilios* or butter-flies. Our wax-eater is of the ſpecies of falſe moths. Its *Papilio* is of the tribe call'd *Phalænæ*, who fly only in the night, and burn themſelves in the candle. Let us trace the hiſtory of theſe from the egg. The egg whence it iſſues having been laid by the female *Papilio*, in ſome corner of a honey-comb; there ariſes from it, ſome days after, a ſmall caterpillar, which may juſtly boaſt that 'twas born in the midſt of the greateſt dangers. Being ſurrounded, on every ſide, with enemies who are active, vigilant, and quick in their revenge; they eſcape a certain death merely by their extremely ſmall ſize, which, during the firſt moments after their birth, prevents their being perceived by the inſpectors or overſeers; and by the ſwiftneſs with which they ſpin inſtantly, and enwrap themſelves with this little ſheath or covering of ſilk, which is then ſufficient to ſecure them from all harms. This caterpillar is of the tribe of thoſe with ſixteen legs. 'Tis ſmooth, has a whitiſh ſkin, and a brown, ſcaly head. There are two ſorts of theſe caterpillars who devour wax: but as I know no other diſparity between them, than that they vary in ſize, and that there is ſome difference in their *papilios*; and farther, that their manner of living, working,

ing, and eating wax are the ſame ; I ſhall ſpeak only of the moſt common of the two ; of that which, when full grown, is about the bigneſs of a caterpillar of an ordinary ſize. I juſt now obſerved, that our little caterpillar or falſe moth, ſpun itſelf, the inſtant after its birth, a ſheath or tube proportionable to its ſize. Theſe tubes are fix'd and glued to the wax ; and may be term'd more properly galleries, as the inſect expatiates, and is at large, and moves up and down them with great eaſe ; and by this name I ſhall diſtinguiſh them afterwards. The firſt care therefore of our falſe moth, at its birth, was to ſecure its life from external dangers ; the next muſt be, to preſerve and prolong it by ſuſtenance. She finds very little difficulty on this occaſion ; the wax on which ſhe builds her gallery ſerving her, at the ſame time, for food. 'Tis enough that ſhe thruſts her head out of her houſe, ſhe finding ſuſtenance all round her door. So long as ſhe meets with wax within her reach, ſhe is not ſparing of it ; but feeds thereon, grows, and her gallery ſoon becomes too narrow and too ſhort for her. As ſhe liv'd upon the flooring which ſtood oppoſite to the entrance of her gallery, ſhe is obliged to thruſt her ſelf forward, in order to find another floor to gnaw ; but then it is incumbent upon her to do this, without being expos'd to the vengeance of the Bees.

CLAR. I now perceive ſuch an inſect at work. She is going to lengthen her gallery, in

order that ſhe may always be under covert, as ſhe walks.

EUGEN. But this would not be ſufficient. She is more ſenſible than we can be, of the ſeveral dangers to which ſhe is going to expoſe herſelf. The falſe moth being grown larger, and advancing ſtill farther into the enemy's country, will thereby be leſs conceal'd, and conſequently more expos'd to the inſults of the Bees. To remedy this, ſhe makes this ſecond part of her gallery thicker, ſtronger, and more capable of defending her than the firſt, which was only a covering or barrier of ſilk.

CLAR. Foreſight and precautions ſhould increaſe, in proportion with dangers.

EUGEN. I am no ways ſurpriz'd, that reaſon ſhould ſuggeſt judicious reflections to you; but am greatly ſo to find them practiſed by inſects. That in queſtion, in order to ſtrengthen the partitions of her gallery, works her ſilk covering or barrier with fragments of wax which ſhe cuts neatly, and in the ſhape of a ball; and in order to forward her work, ſhe joins to it her own excrements, which, for colour and ſhape, are like ſmall grains of gunpowder. As mankind have their arts, the inſects have theirs alſo. The Bee is an excellent architect. Our falſe moth is a ſilk-weaver, who does not work at random, as you will ſee preſently. The inward partition of her gallery, is a cloſe texture of white ſilk; and ſo very ſmooth, that her delicate tender body cannot be any ways hurt by the friction. But the ſmall

particles

particles of wax and the excrements are fix'd on the exterior ſurface of her gallery: they are join'd ſo cloſe together, that they quite hide the ſilk into which they are introduced; and probably ſcreen the moth who inhabits them, ſo very effectually, that the Bees cannot perceive them, no more than we. Probably theſe grains or particles may have this farther important uſe; I mean, they may form a wall almoſt impenetrable to the ſtings of the Bees.

CLAR. I am vaſtly ſurpriz'd that creatures, ſo bold and courageous as our Bees; one of whom is not afraid of attacking a giant of prodigious bulk, a monſter in ſtrength and ſize (for ſuch, methinks, a man muſt appear to the eye of a Bee;) I am greatly ſurpriz'd, I ſay, that theſe haughty creatures, tho' ſtrongly arm'd with talons, with jaw-bones, and a tremendous dart, ſhould yet not ruſh upon the galleries in queſtion, and tear them into a thouſand pieces. Bees can eaſily tear paper, and even ſometimes cut wood; how comes it then that they ſhow a regard, to artificers and to works, which ſeem to me ſo very crazy and weak; and at the ſame time, threaten them with ſudden deſtruction?

EUGEN. A thouſand conjectures might be ſtarted on this occaſion, all which (tho' ſpecious) would, perhaps, be falſe. What appears to me moſt probable is, that the ſmall hooks wherewith their feet are arm'd, tangle in the ſilk which binds together the little particles; and that the Bees finding themſelves catch'd in it, in the ſame manner

as they would be in a ſpider's web, relinquiſh this ſort of fortification, which is ſpread as a kind of net to them.

CLAR. Our Bees muſt ſurely be exceſſively ſtupid. Since the demoliſhing theſe galleries would be ſo very difficult an attempt, why don't they, with their virgin-wax, ſeal and ſtop up the door of theſe falſe moths, in the ſame manner as they ſtick or faſten a ſnail againſt a wall.

EUGEN. This ſhows, that the underſtanding of Bees is confin'd to pretty narrow limits; ſince they have not the ſkill to apply, in one caſe, an expedient which ſucceeds ſo happily to them in another very like it. Here nature leaves them to the mercy of the weakeſt of all their enemies. The latter, indeed, act with the utmoſt prudence. The falſe moth does not quit its gallery, ſo long as it exiſts as a moth. As this inſect began its gallery in proportion to its ſize at that time, this gallery increaſes always in diameter, in proportion as the creature itſelf grows; ſo that the portion or part which was built firſt, does not ſeem larger than a thread when the inſect has left it; but it increaſes in bulk, and at laſt its diameter is equal to that of a quill. Theſe galleries begin commonly near the upper edge of a cell, and are carried on towards the bottom of the ſame. The end where the gallery begins is clos'd; but the extremity towards which it will be lengthned, is always kept open. When a falſe moth is full grown, its length exceeds that of the depth of a cell; and, for this reaſon, the galleries in queſtion are carried

ried directly through the bottom of a cell; and force quite through it, in order to pass into the next cell; and return, thence, to a third, a fourth, &c. so long as the insect's life lasts, till the instant that its sheath or case is to be form'd. Hence it is that these galleries are carried on in a multitude of crooked directions; they passing through every one of the cells, at whose expence they were fram'd.

CLAR. Though I have very little concern for the lives of these false moths, whose race I would gladly see extirpated; I yet should be glad to know, what contrivance they use, in order to extend their gallery, and take their food; for it is not possible for them, to do either without thrusting out their heads; and thus hazard their being seen by our Bees, and consequently of being exposed to their vindictive shafts.

EUGEN. I before observed, that their head is scaly; I mean, that it is cover'd with a stout helmet, which would blunt all the stings in a hive, were they levell'd against it. But this is not all. The first ring plac'd next to the head, is cover'd likewise with a large piece of scale, no less hard than the other. All this part of the insect's body may be exposed abroad, and in open day-light, without any danger; and the false-moth, in order to procure sustenance and perform its work, need not thrust forth a greater portion of its body, than that just mentioned. In fine, when the moth is grown, at the expence

of the wax made by the Bees, and is increaſed to its greateſt ſize; it then muſt make a ſheath or caſe, in order to transform itſelf into a *chryſalis*. This I have not had an opportunity of obſerving in hives; but then, I am able to judge of their manner of proceeding, from what I have ſeen them do in little glaſſes; wherein I put a conſiderable number of theſe moths, with honey-combs, to give me the better opportunity of viewing them at work. There they framed their ſheaths againſt the wax. Theſe ſheaths, which are of the ſize, and in the ſhape of an olive-ſtone, were compoſed of the ſame materials with the galleries above-mentioned; the outſide of them conſiſted of a thick lay of particles of wax, and their excrements work'd up with, or intwin'd in their ſilk; and the inſide was a texture of white ſilk, cloſe, ſmooth, and ſo very ſtrong, that the ſheath reſiſted, in ſome meaſure, to the finger which preſſed upon it. It is commonly about the end of June, or beginning of July, that the caterpillar we are ſpeaking of transforms itſelf into a *papilio* or butterfly.

CLAR. How do you think it poſſible for our moth, when grown to the ſize of a middling caterpillar, to leave its gallery, in order to frame itſelf a caſe or ſheath; and that, when naked, and deſtitute of this rampart impenetrable to the ſtings of the Bees, theſe will permit it to work or labour, undiſturbed, at its own preſervation; and not revenge the injuries they had met with from theſe inſects?

EUGEN.

EUGEN. Its ſheath is only its gallery lengthned. The ſheath begins where the gallery terminates; but the greateſt difficulty does not lie here. 'Tis this. It is neceſſary that our moth iſſue, in a butterfly-form, out of that very ſheath in which it paſſed its *chryſalis*-ſtate. Nay, ſeveral butterflies muſt come forth, at the ſame time, from different ſheaths; among which there muſt be males and females who engender, and the latter muſt lay eggs. All this takes up a pretty conſiderable time; and yet the whole paſſes in an enemy's camp, in every part whereof are guards; centinels, who never ſleep; enemies ever ready to deſtroy; and no gallery for ſecurity.

CLAR. Our moths ſeem to be here involved in the greateſt difficulties, for which reaſon I am the more deſirous of knowing, in what manner they will extricate themſelves.

EUGEN. I cannot ſay whether our moths eſcape unpuniſhed. Probably great numbers of them may loſe their lives on theſe occaſions, and very few may eſcape. However, if only a ſingle female avoids the ſeveral dangers, and has had time to lay her eggs; ſhe is ſo exceedingly prolific, that this ſecond laying may, alone, quite overſpread the hive; and give birth, at once, to ſo great a number of falſe-moths; that the honeycombs, are, in a very ſhort time, undermin'd and devour'd; ſo that the Bees, inconſolable for the havock made in their hive, abandon it, and ſeek an aſylum elſewhere. I have obſerved, by means

means of falſe-moths kept by me in ſand-glaſſes, *&c.* that ſome of theſe butterflies ſlide in between two honey-combs (in thoſe parts where the combs almoſt touched one another) and whence it would be ſcarce poſſible for the Bees to drive them. In theſe places they uſed to lay their eggs; and, in all probability, they do the very ſame in the hives. This operation being performed, they are forced to go in ſearch of ſubſiſtence elſewhere, the butterfly not feeding upon wax. They then eſcape as well as they can. Theſe *papilios* are indued with a peculiar talent, and which ſeems to have been indulged them merely for this purpoſe; I mean, that they are ſwift racers. I don't know any creature of this kind, who is ſo nimble-footed; it runs rather than walks, and walks rather than flies; even when endeavouring to eſcape the hand which purſues it. I once ſaw, in the lower part of a hive, two or three Bees run after a butterfly like that I am ſpeaking of. The *papilio* was chaced by the Bees; and play'd its part ſo well, that, after many windings, our favourite inſects grew tir'd, and the butterfly eſcap'd.

CLAR. I now conceive that the butterflies, ariſing from falſe moths, may engender, lay, and increaſe their race in hives; and iſſue there from falſe moths, hid in corners, whence the Bees were not able to diſlodge them. Their whole life, though paſt in toils and perſecution, may yet be comprehended. Creatures who are not afraid of life, may engage in attempts though ever ſo hazardous. But a circumſtance which

which I can ſcarce conceive is, how it was poſſible for the eggs we are ſpeaking of, to be convey'd into theſe cloſe, remote places. In order for the effecting this, you muſt ſuppoſe that a female butterfly came from without; had croſſed the whole hive; paſſed in the midſt of eighteen thouſand enemies; and alſo conclude that this army, ever careful to drive away all creatures of a different ſpecies from their own, muſt have been aſleep all the time; otherwiſe you muſt return to the opinion of my good old nurſe; and think that the firſt falſe moths roſe from putrefaction.

EUGEN. Without having recourſe to an opinion that claſhes directly with reaſon; we are furniſhed with facts, which may perſuade us that a ſuppoſition, though ſcarce admitted by you, is yet very poſſible. I am certain that a prolific, female falſe moth, when driven from one hive, may get acceſs to another; and winding into the moſt ſecret receſſes of it, may lay its eggs there. I obſerved to you, that our butterfly was a bold racer. 'Tis enough for her purpoſe, if ſhe gets into a hive ſuddenly and unawares. She runs with ſo ſwift a pace, that ſhe is able to paſs through the enemy's camp almoſt unperceived; at leaſt, without allowing time for her being attack'd; and then ſlides into ſome narrow place between the honey-combs, there to lay her eggs in ſecurity. Having done this, ſhe makes her way out as well as ſhe can. She is ſo fond of her poſterity, that, for their ſakes, ſhe will run any

hazard.

hazard, provided ſhe can but ſecure them. Whether ſhe eſcapes afterwards, or is puniſhed for her boldneſs, is little or nothing to the purpoſe: the evil is done, and this is what we were afraid of.

CLAR. What madneſs can thus urge this creature to attempt, at the hazard of her life, to carry her eggs, and lay them, at the bottom of a hive? Is this the only place in the world where ſhe could get rid of the eggs which burthen her?

EUGEN. Perhaps it may. You give me occaſion to take notice of a wonderful providence of Nature, with regard to the ſeveral ſpecies formed by it, and which may ſerve to clear up your difficulty. The Creator, in ſentencing animated creatures to a very limited courſe of life; determin'd that, by a continual, uninterrupted ſucceſſion of children to their mothers, the revolution of ages, given to the duration of the world, ſhould be accompliſhed; and, in order to force theſe Beings to multiply their kind, he indued them with two very ſtrong, and almoſt invincible paſſions. The firſt is the union of ſexes, and the ſecond maternal love. The one preſerves what the other has form'd. Maternal love is felt when the female is inſpir'd merely with the hopes of becoming a mother. The bare reflexion on the near approach of this, rouſes, diſturbs, and makes her take proper cautions for preſerving the life of a future object. She is ſtruck with love for a Being, though yet wholly unacquainted with it.

it. I appeal to you, Clariſſa, who are a mother, for the truth of this.

CLAR. I have been ſenſible to what you are ſpeaking of.

EUGEN. This paſſion is ſtronger in ſome creatures than in others. Nature ſeems to have proportioned it to the difficulty of meeting with food ſuitable to the younglings. 'Tis eſpecially in inſects that this ardent love for poſterity is predominant; and which prompts the females to expoſe themſelves, for their ſakes, to the moſt evident dangers. This exceedingly ſtrong paſſion is accompanied likewiſe, in them, with a knowledge of a very ſingular kind; I mean, their being able to diſcover, among a million of objects, the kind of food ſuitable to their young. Of this I could furniſh many examples which would ſurprize, in caſe you don't know them. That a butterfly who, as ſuch, lived merely on the juice of flowers; ſhould be ſenſible that, from the eggs ſhe carries, worms will ariſe, which can ſubſiſt only on certain plants; and ſhould chuſe, without being able to miſtake, that very one in which it is proper for her to lay her eggs; in order that her younglings, at their birth, may inſtantly find the food proper for them; ſuch a knowledge muſt be wonderful. But what will you ſay of that of certain flies, ſome of whom know that the ſuſtenance, ſuitable to the young they are going to bring forth, is found only in the brain of a ſheep; others in the neck of a ſtag; and others again in the entrails of a horſe; and that the fe-

males in queſtion have the courage to force into places ſo very remote, and which ſeem ſo well defended, to depoſite their iſſue in a place where they may eaſily get food ?

CLAR. You have exhibited to me (Eugenio) and demonſtrated ſo many wonders, that I now can conteſt no longer ; but muſt implicitly believe, at once, whatever you may pleaſe to tell me. The only objection I can make is their being too conciſe. Be ſo good, therefore, as to enter into a greater detail, with regard to the three ſpecies of flies, who lodge their eggs in ſo ſingular a manner.

EUGEN. I will do this ; but will mention ſuch circumſtances only, as relate to the ſubject concerning which you deſire to be inform'd ; I mean, to ſhew that there are creatures, who are forc'd, by nature, to lodge their poſterity in one place, and in that only. A fly, ſomething larger than thoſe which wing up and down our rooms ; that has a ſluggiſh, ſleepy air ; that ſeldom uſes its legs and wings : is yet able to rouze itſelf, and can find both wings and legs, when, after having been impregnated, the time is come for her to depoſite her eggs in a proper place. She is taught that the only food which her younglings can eat, is a certain ſlime ; a mucous ſubſtance, found only in a cavity, lying at the top of the ſnout of ſheep, called *ſinus frontalis*. Maternal tenderneſs renders the female, on theſe occaſions, diligent, active, and induſtrious ; makes her find out ſheep ; and, ſpite of the ſnuffing, and the

the perpetual agitations of the beaſt in queſtion, our fly finds an opportunity of gliding into its noſtrils, where ſhe gets to the *ſinus frontalis*. It was there, and no where elſe, that the egg was to hatch; and accordingly a worm is brought forth, who lives in that place, and ſubſiſts at the expence of the ſheep; paſſes its whole infancy in this retirement; iſſues afterwards from thence, by falling on the earth; and, hiding itſelf there, becomes a fly like to the parent whence it ſprung.

CLAR. Is not the diſtraction, which ſometimes ſeizes my ſheep, owing to theſe worms or maggots?

EUGEN. Nothing can be more probable. Theſe worms are prickly about the belly; and have two ſcaly, and very ſharp-pointed hooks, with which they walk. Now, if they happen not to lie ſtill, in the *ſinus frontalis* of a ſheep, but ſhift their place; their thorns and hooks muſt neceſſarily put the ſheep to exceſſive pain; which, probably, may cauſe thoſe ſort of fits of vertigo on frenzy, to which a creature, naturally ſo mild and pacific as the ſheep, is ſubject. 'Tis doubtleſs on theſe occaſions that we ſee them leap, fly, and daſh their heads ſeveral times together againſt the hardeſt bodies, ſuch as trees and ſtones. Another fly which I am acquainted with no otherwiſe than by the maggots, whence they ſpring; is ſenſible (like the fly juſt mentioned) that the food proper for her young is depoſited in two fleſhy veſicles or bags, lying at the entrance of

the throat, and on the root of the tongue of ſtags; ſhe alſo knows the way to theſe veſicles. Accordingly ſhe takes her opportunity; glides into the ſtag's noſe, and creeps up its noſtrils. Did this fly go merely at random on theſe occaſions, ſhe might ſtop by the way; or proceed, like the ſheep-fly, into the *ſinus frontalis:* on the contrary, ſhe is not at a loſs, but knows perfectly the courſe ſhe is to take, though 'tis the firſt time ſhe ever attempted it. She pierces, at once and without heſitation, through the moſt pitchy gloom; and ſhapes her way through all the winding paſſages leading from the entrance of the noſe to the root of the tongue, where the two veſicles in queſtion lie. Being arrived at the deſired receſs, ſhe lays her eggs, and returns back quite ſatisfied, ſince her family is lodged in ſafety.

CLAR. I muſt confeſs that the particulars you now tell me are exceedingly ſingular. The moſt fruitful, romantic genius, does not ſuggeſt fictions equally wonderful with thoſe preſented by nature, when duly enquired into.

EUGEN. I muſt likewiſe take notice of the horſe-fly, who is no leſs wonderful than the two former ones. The particulars I ſhall here relate, are from one of our naturaliſts, who ſtudied this inſect attentively, and traced all its motions. This fly dwells only in the fields, it never coming near our houſes, at leaſt in thoſe of cities; and, indeed, ſuch horſes only as live in paſture ground, are infeſted by them. The naturaliſt

turaliſt I now hinted at, had the good luck to get a ſight of a fly of this kind, in one of thoſe inſtants (ſo ſeldom met with) when they creep into the inteſtines of a horſe or mare. As the gentleman in queſtion was one day looking in the fields, at his mares, which were feeding peaceably; he perceived them, on a ſudden, grow uneaſy; leap, caper, prance about and ſhake their tails. He did not doubt but that theſe ſudden motions, were owing to the humming of a fly, which hovered round them; and endeavour'd to force its way through the *anus* of one of theſe beaſts. The fly miſſing its opportunity, winged its way, with leſs noiſe, towards a mare, who fed at a diſtance from the reſt. On this occaſion the fly was more ſucceſsful; ſhe getting under the tail, and gliding till ſhe reached the *anus*. Probably the inſect, at firſt, excited only an itching, which prompted the mare to force outward the border or edge of its inteſtine; to open it, and widen its aperture. Our fly made a proper advantage of this diſpoſition, ſhe advancing farther, and concealing herſelf in the foldings of the *anus*. 'Twas then, in all probability, that ſhe finiſhed her operation, and was enabled to lay her eggs. Soon after this, the mare ſeemed quite diſtracted; ſhe beginning to run caper and prance; and, at laſt, threw herſelf on the ground; and 'twas a quarter of an hour before ſhe was eaſy, and fell to feeding again. The inſtances I have here given, in theſe flies and the butterfly ariſing from a falſe moth,

ſuffice to ſhow, that if the author of nature has thought proper to allot, for the food of certain embrios, certain ſubſtances which ſeem ſo remote from them; he, at the ſame time, has taught the females in queſtion how to know theſe ſubſtances; the places in which they are lodged; the way of arriving at them; in fine, all the induſtry and fortitude requiſite, in order for ſurmounting the various obſtacles which oppoſe the diſcovery of them. The Creator even required that this ſhould be done at the hazard of their lives: for the life of every individual is leſs precious than the preſervation of the whole ſpecies. I ſhall here conclude all I had to ſay with regard to the enemies of Bees. I might have added the ill treatment they meet with from men; the diſeaſes they are ſubject to; and the multitudes of them who periſh by cold and hunger. But theſe articles will furniſh matter ſufficient to compoſe entirely our next converſation.

CONVERSATION XVII.

Concerning the beſt manner of taking the honey, and the wax, out of hives, without deſtroying the Bees. Of the neceſſity of ſecuring theſe, during winter and ſpring, from cold and hunger.

CLARISSA.

OUR laſt converſation put me in mind of a reflexion I have often revolved, *viz.* that there are few creatures, upon earth, but have their antagoniſts among other ſpecies of animals; and that man is the general opponent of them all. He looks upon himſelf as their king, and accordingly exerciſes a tyrannic ſway over them. He imagines that the whole earth, with all things contained therein, was made for his uſe only; that he has an incontroulable right of life and death over all things who breathe. Methinks 'tis whimſical enough that man, when he eats his ox or ſheep, ſhould imagine he poſſeſſes himſelf of a thing to which he had a juſt and lawful title.

EUGEN. The lion may, with equal juſtice, fancy himſelf impowered to feed upon man, and the wolf on ſheep. But 'tis my opinion, that neither the one nor the other could find any

other original title, of their ſovereignty, than force or cunning. But let us engage no farther in a queſtion, as this would raiſe up a multitude of gainſayers, whoſe intereſt it would be to differ from us in opinion. I ſhall only obſerve, that, if our anceſtors were uſurpers of the empire they obtained over brutes; long poſſeſſion has given us a ſort of title to this ſovereignty; but yet, this will not permit us to exerciſe ſuch a power, any otherwiſe than with oeconomy, prudence, temperance and diſcretion. Beſides the right which we claim over their perſons; we have others, (and theſe ſeem better founded) on the things belonging to them. Some creatures have ſuch a ſuperfluity as would be utterly loſt; wherefore then ſhould we not make advantage of it? This is ſeconding the views of nature, who ſeems to offer them us. Hens lay a greater number of eggs than are neceſſary for the propagation of their ſpecies. Cows gives milk with ſuch a profuſion, as plainly ſhows that all was not deſtin'd as ſuſtenance for their calves. Sheep let us ſheer their wool, which afterwards grows again. Bees have the art of renewing their wax, whenever they are diſpoſſeſſed of it. Let us therefore divide thoſe ſeveral things with them; but then let us imitate, on theſe occaſions, good kings, who exact no more contributions from their ſubjects, than what may enable ſuch monarchs to compenſate for thoſe, by adminiſtring juſtice to their ſubjects; by indulging them protection, and procuring them plenty. We behave thus towards

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ſuch creatures as are kept in our yards: why then ſhould Bees only feel the effects of our cruelty? We deſtroy every year, in ſeveral provinces of the kingdom, and eſpecially about Paris, a great number of hives; and this merely for deſtruction ſake. In the places I am ſpeaking of, a cuſtom, equally ridiculous and cruel, prevails. The perſons hinted at, employ no other method, in order to get the honey and wax out of the hive, than to kill all the Bees who inhabit it. For this purpoſe they make a hole in the ground, large enough to receive the bottom of the hive. In the bottom of this hole, rags ſmeared with brimſtone, and ſet on fire, are thrown. The hive is ſet on the vapour; when immediately ſo much earth is drawn round it as may ſuffice to prevent the Bees, and even the ſmoak from getting away. The ſtench of the brimſtone, with which the hive is inſtantly filled, ſoon ſtifles all the ill-fated Bees. There are other kinds of death, the invention whereof various authors thought meritorious; but which I ſhall think it a merit to conceal. In the places where this practice, equally unſkilful and barbarous, is uſed; people apologize for themſelves by declaring, that, they deſtroy, on theſe occaſions, none but the old Bees, from whom no farther harveſt can be expected; Bees who would furniſh no more ſwarms; but would eat, during the winter-ſeaſon, a conſiderable quantity of the honey ſtor'd up by them. In this manner would a tyrant argue, who, after he had cut to pieces all the inhabitants of one of his cities, merely for

the ſake of plundering their gold and ſilver; ſhould endeavour to juſtify his monſtrous cruelty, by declaring, that all the inhabitants were very antient, and incapable of furniſhing poſterity next year.

CLAR. This is a perfect picture of the avarice with which man is fired. All his arguments, as well as his conduct, are big with horror. Whenever I ſee injuſtice and cruelty go hand in hand, I conclude from thence that they are led on by avarice; and I am ſeldom or never miſtaken in my conjectures.

EUGEN. Your reflexion, Clariſſa, is exceedingly juſt. Who told the perſons hinted as above, that all the Bees in a hive are old? We ourſelves have ſeen, when a ſwarm was iſſuing forth, that it conſiſted of old and young Bees; and that many, of both ſorts, remained in the abandoned hive. When the Goths and Saxons ſent colonies into Gaul, did they leave, in their own country, none except old men, who were unable to get ſucceſſors? Hives recruit themſelves perpetually like cities and governments. Tho' the Bees of a hive happen to be deſtroyed by ſome accident, yet many exiſt eight or ten years. I knew a peaſant who preſerved a hive above thirty years. The murtherers above-mentioned add, that Bees would devour, during winter, all the honey ſtored up by them. But this is another argument dictated by avarice, which ever miſtakes its true intereſt. It muſt be confeſſed, that our inſects would eat the greateſt part of

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ſuch honey, and perhaps all; ſince they hoard it up merely as proviſion for themſelves. But does it not argue more wiſdom in us, to be contented with taking away a portion at different years, and in various ſeaſons of the ſame year, as is the practice in many countries; than to carry off the whole at once? By what name would you call a peaſant, who ſhould kill his goat, merely that he might, at once, take all the milk contained in the bladders of the animal?

CLAR. How delighted am I to hear you confound covetouſneſs; and undertake the defence of innocence, in oppoſition to oppreſſion and tyranny! Would I could enact laws, a dreadful proclamation ſhould then be publiſhed inſtantly againſt Bee-cide.

EUGEN. There is really ſuch a one. Alexander de Montfort, whom I before mentioned, cites a law, enacted by a grand duke of Tuſcany; forbidding all perſons to put Bees to death, upon pain of being puniſhed arbitrarily.

CLAR. Delightful prince! how juſtly did he deſerve to command over others! Why was not this laudable example imitated by all the monarchs upon earth? Myſelf will make ſuch an injunction, and cauſe it to be publiſhed throughout the whole extent of my little territories.

EUGEN. This will be well; but then you, at the ſame time, muſt reſtore another practice; I mean, the gentler method of taking away the wax and honey.

CLAR.

CLAR. 'Tis from you that I expect to be taught this.

EUGEN. When a person has used his utmost endeavours to preserve Bees, and to multiply, and produce large harvests from them; such a one may justly expect to share the fruits of their labours with these insects; I say divide with them, and not seize upon the whole, and butcher them at the same time. This sharing or dividing with the Bees, is performed by only cutting off some portions from every hive. Such is the custom in several countries, where they are cut in different seasons; in some this is done at the end of February, or in the month of March. We then may, without injuring the Bees, take away a considerable quantity of their wax; and at the same time, of the honey remaining of their winter-hoard. There need no more be left them, than what may be necessary for their support, during the inclement days, between the end of winter and May. We also may take out several of their combs, which are empty of honey; particularly those, the wax whereof is grown too black. What is thus taken away from Bees, at a time when they have an opportunity of recruiting it soon, is a superfluity which, so far from injuring, gives them more room, and an opportunity of making new work. However, as the time, for this operation, differs in many places; it must vary according to the different provinces or countries; and according to the more or less clemency of the seasons. Our harvests are

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not all gathered in the ſame month. In proportion as the flowers ſpring forth, or are kept back, the labours of the Bees are either forwarded or retarded. In ſome provinces the honey-combs are not cut till July or Auguſt.

CLAR. This article, of cutting the honey-combs, ſeems to me a very bold attempt. D'ye know, Eugenio, that, ever ſince I have kept Bees, I never had the courage to be preſent on ſuch occaſions?

EUGEN. D'ye think you'l dare to liſten to the deſcription of it? 'Tis a military expedition, (and one of the boldeſt) to carry off, from the inſide of a hive, honey-combs which thouſand of Bees, ſtrongly armed, are always prepared to defend. And, indeed, he who engages in this enterprize, ſhould be armed-cap-a-pee; he muſt uſe the ſame precautions obſerved by your gardiner, when he took a ſwarm from a tree, in order to remove it into a hive; I mean that he muſt well cover his face, his hands and legs. Nevertheleſs, ſome peaſants, as I obſerved before, uſe none of theſe precautions. With regard to the time of day fit for this operation, ſome conclude noon to be the beſt; from a ſuppoſition that the greateſt part of the Bees are then in the fields. However, I would not adviſe any perſon to truſt to this. About twelve at noon, during the hot days, the leaſt work is done by the Bees; and conſequently moſt of theſe inſects are then in the hives. In caſe the noon, of temperate days, is choſen; the more Bees there are abroad,

abroad, the greater number will be returning home every inſtant. All theſe little inhabitants, exaſperated to find, at their return, their city demoliſhed, and their poſſeſſions plundered, will haſte to vengeance; and the enraged ſquadron will not give quarter to the common enemy. Others are of opinion, (which is alſo mine) that the beſt time is the morning; as our inſects are then ſtill pinched by the cold of the preceding night. To quiet the Bees the more, and make them leſs furious, the ſmoaking them will render theſe inſects yet more ſenſeleſs. To effect this, the hive muſt be lifted up a little, when the ſmoak of a rag, held in one's hand, being introduced; this makes the Bees giddy, and forces them to move towards the ſummit of the honey-combs. We then ſeize the inſtant, and turning the hive ſideways, lay it on a chair or bench; of ſuch a height as may facilitate the intended operation. And now, a ſingle glance directed to the hive, ſhows at once what combs are fit for cutting. Then with a knife, whoſe blade bends like that uſed for cutting vines, we pare away whatever may be thought proper. The ſurvey of ſuch combs as are full of honey, and thoſe which are very old, determine the operator where to cut; and either to take whole combs away, or only parts. In a word, 'tis allowed to be juſt in ſome meaſure, and even neceſſary, to leave the Bees about half their honey. 'Tis proper to keep the rag burning during the whole operation; and to let its ſmoke deſcend in the hive, in order to keep the Bees in.

CLAR.

CLAR. All theſe precautions are extremely ſeaſonable. But do not the perſons who thus take away honey and wax, run the hazard of carrying off, and deſtroying at the ſame time, a great number of little worms or maggots, which might ſoon have turn'd to Bees; and conſequently incur the penalties hinted at in the duke's edict?

EUGEN. Your obſervation is quite right; this being an error which many, through careleſsneſs, often commit. However, a little experience in honey-combs; in diſtinguiſhing thoſe whoſe cells are ſhut; and, among theſe, the being able to diſcern ſuch as are ſtore-houſes of honey, from thoſe which contain *nymphæ*, will prevent our committing any miſtakes on this occaſion. By firſt breaking off a little piece from the honey-comb, and examining its cells, we eaſily diſcover whether any worms, *nymphæ* and eggs, are incloſed in them; in which caſe we muſt not touch them. Some authors adviſe us to cut ſuch combs only as are towards the back of the hive; but this rule is too general. The beſt is, to pitch upon ſuch combs as are fulleſt of honey. After having taken what we think proper from a hive, we then ſet it in its place again. That ſide, whence the largeſt quantities have been taken, ought to be ſet forward; that is, be moſt expoſed to the ſun; the Bees chuſing rather to work on this ſide. Some perſons have thought upon an expedient on theſe occaſions; and which is judged by them as a medium, between the deſire of taking the produce

of a whole hive, and the cruelty of putting all its inhabitants to death. The expedient I here mean is, the removing the Bees of a full hive into an empty one. However, this practice is not convenient except in ſpring; and during ſeaſons when the fields may abundantly furniſh Bees wherewithal to repair, with ſpeed, the loſſes they thus ſuſtain. Nevertheleſs, by this practice, the eggs are deſtroyed; which is always a conſiderable loſs, and conſequently ſhould be prevented as much as poſſible. I know but one caſe in which this is abſolutely requiſite, and that is; when the falſe moths above-mentioned are multiplied to ſuch a degree in the hive, that the ſafeſt courſe the Bees can take is to abandon it to them.

CLAR. You have made me quite eaſy, by thus teaching me to reconcile our intereſts with the lives of our diminutive ſubjects. I muſt now intreat you to inform me, what methods muſt be employed, in order to enable the Bees to pay us their contributions, without oppreſſing them; or giving them the leaſt cauſe of complaint againſt us.

EUGEN. To effect this, we muſt protect our inſects to the beſt of our power, againſt all ſuch baleful accidents as we only can make them eſcape. Beſides the living creatures who make war upon Bees, there alſo are, in the frame of the univerſe, various ſcourges or calamities, which it is ſcarce poſſible for them to ſhun. 'Tis enough that they themſelves furniſh the admirable

ble industry and contrivances of which we have taken a view; and join diligence and assiduity to a toil, the fruits whereof we desire to share with them. 'Tis therefore just that we, on the other hand, endeavour to make their lives commodious and easy; and remove from them whatever may annoy. The two scourges which prove most fatal to Bees, and sometimes destroy more than half our hives, in one year, are cold and hunger. If therefore you are desirous of preserving your Bees, you must guard, as much as possible, against these.

CLAR. Is it so very difficult to secure Bees from cold and hunger?

EUGEN. Much more so than is commonly imagined. Frequently, by an endeavour to screen them from cold, we expose them to die with hunger. This happens in manner following. They, like all insects, pass the winter; are sensible to its inclemencies, and do not take any food.

CLAR. What use then will they make of those closed store-houses, in which they had laid up their provision of honey? Hitherto I supposed, that this was to subsist themselves, after the season of flowers was ended.

EUGEN. That's very true; but not in so great a latitude as you imagine. Let us resume matters a little higher, in order to acquire a just idea of this. Among the infinite variety of creatures formed by nature, some of them, especially insects, cannot find food necessary for the sup-

port of their lives, except during part of the year. Theſe, for inſtance, who ſubſiſt on the leaves of trees, plants and fruits, are reduced to the neceſſity of exiſting without food during the other part of the year, when there are neither leaves, plants or fruits. 'Tis not difficult to conceive, the poſſibility of their undergoing ſo long a faſt. The only reaſon of our taking ſuſtenance, is to repair the loſſes we ſuſtain perpetually by motion and perſpiration. Was it in our power to ſtop, in ourſelves, all motion and diſſipation of our parts; there is no doubt but we then might ſubſiſt without food, during the whole time that we ſhould continue in ſuch a ſtate. The inſects do what it is not in our power to effect. They are able to keep their bodies in perfect reſt during the whole winter-ſeaſon; in all probability they do not waſte many animal ſpirits in thinking; as to their perſpiration, which is during the very hot ſeaſon, 'tis ſtopped by the cold; hence there is no farther diſſipation of them; they have no farther occaſion to recruit, or conſequently to eat. The caſe is therefore the ſame with Bees, as with other inſects, in ſome few particulars excepted. Moſt inſects are able to reſiſt cold weather, though exceedingly rigorous. You are but too well acquainted with the ſpecies of caterpillars, who make ſuch cruel havock in your orchards and woods; ſpin webs, and paſs the whole winter at the extremity of the boughs of trees. This inſect can reſiſt ſuch a degree of cold, as is four or five degrees ſtronger than

than that of 1709. Others would perish in so rigorous a season; but all, or most of them, (be the cold ever so sharp) are able to wait, abstemiously and in repose, till the season comes round again, during which the earth will produce the sustenance fit for them. But the Bees are not indued with this talent; they being able to resist only a certain degree of cold, and this not over severe. That which stops vegetation, and the springing of flowers, reduces them to a state in which sustenance seems not necessary; it keeps the Bees in a sort of lethargic state, during which they don't perspire; at least on such small quantities, that their bodies suffer very little from it. Were the winters always equally cold; in such a degree as would only throw them into a kind of lethargy, till such time as the springing forth of flowers, they then would have no occasion for the honey stored up by them; but, during the season we are speaking of, the days are far from being like one another. I will suppose Bees cramped or benumb'd by the degree of cold above-mention'd: now should the frost break, or the air soften; should the beams of a resplendent sun play on the hive and warm it, our insects would rouse instantly from their drouziness. This sudden heat revives, and draws them out of their lethargic state; they flutter their wings, and are in motion; they are restored to their former activity, and at the same time to their appetite. 'Tis then they are reduced to the necessity of taking sustenance. As the fields will

not ſupply them with food, they open their magazines, and have recourſe to the honey and crude wax which had been laid up in them. They begin by opening the lower cells; they not touching the upper ones till afterwards, though theſe were firſt filled by them. They certainly muſt have good reaſons, for feeding upon that honey firſt which was gathered in laſt. I imagine that the ſummer or autumn honey is not thought by them ſo fit for keeping, as that of the ſpring; and that it perhaps thickens ſooner. In a word, whenever the cold increaſes, they revert to their lethargic ſtate; and when it ſoftens, their craving for food returns. Thus, the ſofter the air continues during winter, the more honey the Bees conſume; the larger conſumption is daily made of the quantity ſtor'd up by them; and conſequently, they run the greater hazard of conſuming their whole ſtock, before the flower-ſeaſon comes round again. Thus they are in danger of being ſtarved. On the other hand, if they are not numerous enough in the hive, or if the winter is too inclement, they very probably may be killed by the cold. A certain degree of cold is therefore favourable to Bees; that which only pinches or benumbs them, ſecures them from the danger of ſtarving; that which does not pinch them, may occaſion their being famiſhed; and that which pinches or benumbs them too much, is mortal. Hence 'tis plain that Bees, during ſevere winters, are expoſed to periſh through cold; and, in ſoft winters, to be ſtarved to death. Our Bees know

know perfectly well, that they are expoſed to theſe two calamities; and for this reaſon they exert their utmoſt to ſecure themſelves from them. They love to be exceedingly numerous in their hives; they, doubtleſs, knowing that the more populous they are, the warmer their inward air will be; and by this means they preſerve themſelves from the ſeverity of the winter. They likewiſe ſecure themſelves from the famine to which a too mild winter would expoſe them, by laying up ſtores of honey and crude wax.

CLAR. Since theſe little creatures are ſo vigilant with regard to their own intereſts, what need we concern ourſelves about them?

EUGEN. Tho' nature has endued Bees with ſo much knowledge, as to be ſenſible of their own wants, it yet has not thought proper to give them powers ſufficient to guard enough againſt them. Nature, very probably, thought it requiſite that we ſhould lend a helping hand on theſe occaſions; and partake in their toils, in caſe we deſired to ſhare in the fruits of them. For this reaſon, if we are willing to preſerve our Bees during the winter-ſeaſon, we muſt attend eſpecially to two things; I mean, to preſerve them from periſhing through cold; and to take care that they may not be in want of ſuſtenance, when the winter is mild, or continues too long ſo. I'll now inform you, with reſpect to theſe two articles, of all the particulars which experience has taught us.

CLAR. I ſhall liſten to you with pleaſure. My Bees may depend upon being tenderly us'd,

the inſtant I ſhall be told, how to fix upon ſuch a degree of cold as is neceſſary for their preſervation.

EUGEN. Every Bee is not able ſingly to reſiſt, for a long time, a degree of cold much ſofter than that which can congeal water. I don't know any inſect to whom heat is ſo neceſſary. Bees die with cold in an air, the temperature of which would be found ſoft enough, by all the other inſects of our climate.

CLAR. How is it poſſible then for them to live in gardens, during very ſevere winters? For, tho' great numbers of them die, you yet muſt own that ſome ſurvive; nay, that multitudes of them reſiſt this rigorous ſeaſon, and are alive in ſpring.

EUGEN. This is becauſe the air of a hive is not the ſame with that of a garden. 'Tis ever hotter; and this heat is greater or leſs, according as the hive is more or leſs populous. Figure to yourſelf that a hive reſembles a play-houſe, on the occaſion we are ſpeaking of. Was ſuch an edifice to be in the middle of the fields, during a fine winter's day; when the ſeverity of a froſt was exceſſive, and there was but a ſingle perſon in this theatre; you'll naturally conceive that ſuch a perſon muſt be almoſt as ſenſible to cold, as others who ſhould ſtand on the outſide of it. But ſhould a thouſand perſons come into it, the cold would begin to leſſen. After this, ſhould benches be fixed ſufficient for ten or twelve thouſand perſons to ſeat themſelves; as every individual

dual would furniſh his quota of natural heat, the air within this play-houſe might then change to an agreeable temperature; whilſt the air out of the theatre, would be ten or twelve degrees colder than that which can freeze water. But how great would be the alteration, ſhould the ten or twelve thouſand perſons we are ſpeaking of, take it into their heads to rouze all together, run up and down, and exert the moſt vigorous motions? There is no doubt but theſe would at laſt work themſelves into a ſweat; and communicate to the air in the theatre, a degree of heat equal to that of the hotteſt ſummers. In applying this compariſon to our hives, you'll eaſily conceive that, accordingly as they are more or leſs populous, the better they'll be enabled to bear up againſt the extremeſt cold. Thus you perceive how eaſy it is for us to ſecure our inſects from this calamity. Our only buſineſs is to take care, at the approach of winter, that ſuch hives as we are deſirous of preſerving during this ſeaſon, may be well ſtock'd with Bees. Hence ariſes a maxim of great importance to the preſervation of theſe inſects, which is, that when ſome of our hives are thinly peopled, we need only make one hive of two; I mean, remove all the Bees of one hive into the other, and this we term coupling or marrying them. By this means our inſects will be ſo populous, as may enable them to paſs the winter, leſs liable to diſaſtrous accidents.

CLAR. I had been told of this practice before, but was unacquainted with the reaſon why

it was done. However, I can ſcarce imagine that Bees, who, when I touch them, don't make a ſenſible impreſſion of heat upon my finger; ſhould yet be able to communicate to the air with which they are ſurrounded, a heat like to that you would have me ſuppoſe, by your compariſon of twelve thouſand perſons in a play-houſe. Mankind may be endued with ſuch a natural heat as is not found in Bees. You know much better than myſelf, that compariſons are no proofs.

EUGEN. I therefore muſt convince you by experiments. One day in January, I had placed in my garden, and at the ſide of a glaſs hive, a thermometer. It ſtood at three degrees below froſt; that is, the air was three degrees colder, than was neceſſary to freeze ſtanding water. A pane of glaſs was broke in one of the corners of my hive; when, taking away what I had put to ſtop this opening, I thruſt my thermometer into the hole of the hive, after taking it from its wooden frame. Notwithſtanding that the honey-combs, on which the ball of the thermometer ſtood, were at a pretty conſiderable diſtance from the center, and from the place whither the Bees had retired for ſhelter; the fluid roſe nevertheleſs quickly, and aſcended to ten degrees above froſt. Theſe ten degrees denote that of the temperature of cellars. Had it been poſſible for me to advance the ball of my thermometer, among the groop of Bees in the center of the hive; poſſibly the fluid would have roſe as high, and perhaps higher,

higher, than it does in many of our hot ſummer-days.

CLAR. Methinks this experiment muſt be unanſwerable.

EUGEN. But I don't intend that you ſhall be ſatisfied barely with a ſingle experiment. Here follows another of the ſame kind, made by me in the month of May. I let down the ball of a thermometer through a hole left by me purpoſely at the top of the hive. On this occaſion the ball was in the center of the cluſter of Bees who were at reſt; and the fluid roſe to thirty-one degrees above froſt, which muſt have been done by a heat ſtronger than that of our moſt ſultry days in ſummer.

CLAR. What you tell me is ſurprizing.

EUGEN. And yet this is nothing; the Bees procuring themſelves a much greater heat, when they are in motion. I had kept, during winter, Bees in a hive, into which they had been removed, without being allowed the leaſt portion of honey-comb: in ſhort, they were quite deſtitute, in ſome meaſure, of neceſſaries. At the time I am ſpeaking of, the external air was very little above froſt. The glaſs panes of my hive were cold to my finger. But whenever I diſturbed theſe Bees, either purpoſely or undeſignedly; whenever they diſperſed themſelves, and that they began to move tumultuouſly up and down; to flutter their wings, and to make a ſtrong humming; the hive grew, on a ſudden, ſo very hot, that when I touch'd the very ſame panes of glaſs which I before found cold; they now felt as hot

as

as if I had held them near the fire; and in such a degree of heat as is scarce supportable.

CLAR. Here we have an image of the ten thousand men sweating in the theatre you were speaking of; at the same time that the frost without, was as violent as possible.

EUGEN. This proves to you, that the more Bees there are in a hive, the less we need to fear that the air should grow cold enough to destroy them. Where these are very numerous, they have heat enough among themselves to keep one another warm.

CLAR. I yet have heard my gardiner say, that the Bees of some hives, after resisting the winter, died with cold in the spring.

EUGEN. The same has happened to my Bees, the cause of which I found, and also a remedy for it. The cause is, when the Bees, at the closing of winter, take their flight too soon. As they go from an excessively hot air, to another that is too cold for them to bear, they are struck with it and die. If these too impatient Bees happen to be very numerous, the hive is depopulated by so many; for then the hive we are speaking of, which, by its being so numerous, could resist the rigours of the winter; is not able to bear up, against the cold days still felt in March and April. However, this might be remedied, by not letting them out too soon. As 'tis we who are acquainted with the state of the weather out of the hive; it consequently is our business to regulate the time when it will be

proper

proper for the Bees to ſally forth. I'll ſoon inform you how this is to be done. But let us not quit the meaſure or degree of cold which our inſects are able to ſuſtain; 'till we have particulariz'd every thing which experience may have taught us on theſe occaſions. I before obſerved, that a degree of cold which would be ſlightly felt by mankind, and the generality of inſects, is too violent for Bees. Farther, an air which is pretty ſoft with regard to us, is too cold to them; I mean of every Bee in particular; of ſuch of our inſects as are alone, at a diſtance from their body; or where they are but very few in number. Here follows a proof of this. I ſhut up about the end of November, two dozen of Bees in a ſand-glaſs. I then placed it in a cloſet, whoſe air, during the whole day, was between four and five degrees above froſt. In leſs than an hour they appear'd dead. Being deſirous, in the evening, to know whether they were really dead, I caus'd them to be warm'd, when they revived with the heat, and all gave ſigns of life. I then carried them inſtantly into the ſame cloſet whence I had taken them; and immediately they ſeem'd to fall dead again. The next morning I warm'd them anew, and they again roſe to life. I made them undergo, for three days alternately, this cold and heat; but at laſt my experiment prov'd fatal to them, they riſing no more to life after the third day. Another experiment made by me (if I remember well) was on the firſt of December. I then put a dozen and half of very ſprightly

Bees

Bees into another ſand-glaſs, which I ſet in my cloſet, and in a much ſofter air than the above-mentioned. The fluid in the thermometer ſtood, in the day time, at fifteen degrees; and eleven at night. Nevertheleſs this air, tho' gentle like that of a ſoft ſpring, reduced them in three hours to a lethargic ſtate. I left them in it three days; after which I endeavoured, but in vain, to reſtore them to life.

CLAR. How ſhall we reconcile this with their going abroad in ſpring, during a ſeaſon when the ſame air, ſo far from killing, revives and invites them to work?

EUGEN. This is eaſily reconciled. The preceeding experiment related to Bees confined in a ſand-glaſs; Bees who were very few in number, and at reſt: But ſuch as iſſue from the hives during the firſt fine days, come from a place that was very hot; and acquire, by labour and motion, the requiſite heat. An air which, were they few in number and unactive, would be too cold; would be found ſupportable when they are in motion. 'Tis juſt the ſame when Men, during winter, preſerve, by ſwift walking, the heat they had got by ſetting before a good fire.

CLAR. I underſtand you. In what poſition are they, in the hive, when it freezes; and that they find themſelves falling into their lethargic ſtate? Do they haſte and hide themſelves in the cells? Do they take up their ſtation between the honey-combs?

EUGEN.

EUGEN. This you yourſelf may eaſily ſee, and without any danger to your perſon, next winter. You ſhall make choice of a day when it freezes; ſhall then order one of your hives to be laid on one ſide, and even turn'd upſide down, if you will: you then will ſee the Bees between honey-combs, cluſter'd and fix'd quite cloſe one to the other; they'll take up but little ſpace, and this towards the lower part of the hive; at moſt, towards the middle of its height. They'll appear ſo benumb'd to your eye, that you'll imagine them dead: ſuch is the poſture and condition in which they paſs a great part of the winter. I will obſerve on this occaſion, that one of the duties we owe our Bees is, to viſit their hives every morning, not only during winter, but eſpecially after the cold nights of the ſpring; for, in caſe the degree of heat they procur'd to themſelves, is not ſtrong enough to reſiſt the violence of the cold, their lives will be in danger. To enable you to guard againſt this, 'twill be enough to obſerve, that the firſt effect which cold has upon Bees is to benumb them; and that in proportion as the ſevere weather increaſes, it has ſo ſtrong an influence upon them, that they appear as dead; and their ſtrength is enfeebled to ſuch a degree, that the muſcles of their legs loſe the contraction neceſſary for keeping them hook'd one in the other. Little cluſters of them will break away, and fall to the bottom of the hive; here they will ſeem as dead, on which occaſion we may handle and take them up by heaps, without

without fearing their ſtings. However, tho' they are found in this condition, you yet need not be alarm'd; for in caſe they have not been too long ſo, you may eaſily extricate them from the danger with which they are menac'd: only let them by the fire, and they'll recover. This ſecret was not unknown to the antients. Varro and Columella, two writers on rural affairs, who, agreeably to the opinion entertain'd in their time, thought this lethargic ſtate a real death; declare, that the way to recall theſe Bees to life, is to lay them on hot aſhes. I fancy that you have no manner of notion of this ſort of reſurrection, for which reaſon I ſhall not trifle away time, in pointing out to you the abſurdity of that word. I proceed therefore to the remedy. That of hot aſhes is good; but that of laying them upon dryers is better; or to put them in large boxes or glaſſes, and bring them near to a gentle fire, is beſt of all. I have ſometimes had hives, all the Bees in which appear'd lifeleſs, tho' they had laid between the honey-combs. Then, to revive them, without cauſing any havock; I plac'd, under the hive, a ſmall earthen pot, in which were a few burning coals, cover'd with a large quantity of hot aſhes. This expedient is the ſimpleſt and moſt eaſy; however, as I obſerved above, we muſt not leave the Bees too long in this lethargic ſtate; for, ſhould it be ſuffer'd to continue many days, the remedy I am ſpeaking of would be attempted without ſucceſs.

CLAR. The particulars I have now heard are exceedingly curious; however, I don't yet know how to find the exact degree of cold neceſſary for keeping my Bees in a lethargic ſtate; and this I am impatient to be taught.

EUGEN. I ſhould firſt give you a compleat idea of the theory, on which the practice I deſign to inſtruct you in is grounded. The degree of cold requiſite for Bees, during the winter-ſeaſon, is not a fix'd point, nor eaſy to be prov'd. The diſpoſition of the place in which they are kept during this ſeaſon; the ſituation, the greater or leſs number of Bees in a hive; all theſe cauſe different degrees of cold to be required. A very populous hive will live in a place, the air of which will be cold enough to kill one that is more thinly inhabited. One hive ſhall be thrown into that uſeful lethargic ſtate, by the ſame degree of cold, which would be a degree of heat for another. Whilſt the Bees, in one hive, ſhall be conſuming their proviſions, the Bees in another ſhall be expiring. Should we enter into ſuch a detail, as might teach us to preſerve every individual Bee from the ſeverities of winter and hunger, we ſhould be obliged to have recourſe to expedients which would perhaps, be found impracticable, at leaſt by country people; ſuch expedients as would require time and expences, which the profits made by hives could never pay. The methods or expedients, for our purpoſe, are general ones; ſuch as may be eaſily put in execution, and whoſe tendency is moſt beneficial.

'Tis

'Tis on theſe I now intend to treat. 'Tis certain that if hives, inſtead of being left during the whole winter in gardens; there expos'd to all the rigours of cold, were remov'd, under covert; they, by this means, would not be in ſo much danger of periſhing by the cold, as when expos'd to the open air. One practice of very great antiquity, and uſed in ſeveral provinces or countries, is, to ſtop all the apertures of the hives about the beginning of November; and then remove them to a green-houſe, or ſome place equivalent to it. However, this practice, ſo far from being ſufficient, is expoſed to many inconveniencies. Such hives as are ſtrong and very populous, will reſiſt the extremes of cold; but theſe rigours will deſtroy the weaker hives: for we cannot compoſe our hives of an equal number of Bees, nor even in ſuch a proportion as may be pretty near one another; and ſome of our hives will always be found weak, with regard to exceſs of cold. In fine, that method which propoſes the ſtopping up every opening or cranny of the hives, and even the doors, in order to keep out the cold, make the Bees ſubject to many fatal diſeaſes. A too cloſe air corrupts daily, it being infected by the ſmell of the Bees. Their perſpiration moiſtens it very much; and moiſt air kills, and even rots them in the hive. From theſe conſiderations, ſeveral perſons (ſpite of the great riſk to which ſuch hives, as are left in the open air during the whole winter, are expos'd) think it ſafer to let them ſtay abroad.

CLAR.

CLAR. Methinks such a medium might very easily be found on these occasions, as would remedy all these inconveniencies: for this purpose we need but leave our strong or populous hives in the garden, and remove all the weak ones into the green-house.

EUGEN. Your observation is very just; and therefore I shall not compare it with another most trifling one, which some of the antients have taught us, and this is, to lay some dried carcasses of birds into our hives; they asserting that these secure them from the cold. As I am persuaded you will not lose time in repeating this experiment; I shall consider only the division of the hives just now mentioned. This would be the most expeditious for such persons as are thrifty of their time; but far from being the most salutary with regard to Bees. If you remember how very difficult it is to secure Bees from cold, you will conclude that the warming of your green-houses will not be sufficient to preserve the weak hives. Though these places be ever so well shut, the extreme rigours of cold will yet pierce into them. To make them, therefore, fit for our purpose, a fire should be kept all the winter, in these green-houses; in like manner as in those where foreign plants are nursed: but as this would be an over-great expence for country people, and take up too much of their time, it consequently cannot be of use to them. To remedy this, I hit upon a method, which, after several trials, was found very successful. To prevent any mistake

in this experiment, I made it on hives of every kind; ſome of them being very weak or thinly inhabited, and compoſed of only a handful, as it were, of Bees. I propoſed, on theſe occaſions, to unite together the three views, which all perſons who deſire to preſerve their Bees, muſt attend to. Firſt, to ſecure my inſects from the moſt violent extremes of cold: ſecondly, not to ſtop the door of their hives, but leave them the liberty of ſallying forth on fine days, and thus make the air capable of being renew'd; thirdly, to let them meet with food in their hive, in order that they might not be forced to go and ſeek it abroad; and conſequently prevent their being expoſed to ſuch ſeverities of cold as would prove fatal to them. There cannot be a greater ſimplicity than in this method, and is ſo well ſuited to peaſants, who commonly have plenty enough of the utenſils employ'd by me on this occaſion. I took an old caſk, whoſe head was knocked off; when ſetting it upright, I threw, at the bottom of my caſk, a lay or bed of dry and very cloſe earth, about four or five inches thick. After placing boards on this lay, I ſet my hive on this flooring. I then filled all the void ſpaces between the ſides of the caſk and the hive, with the ſame kind of dry, cloſe earth, quite to the top of the caſk. You will naturally ſuppoſe, that, by means of ſuch a clothing, which is neither dear, nor difficult to be come at, my Bees were well ſecured from the ſeverity of the winter.

CLAR.

CLAR. This I can eaſily imagine, and I even ſuppoſe that they were quite ſtifled; an infallible ſecret to prevent their dying with cold.

EUGEN. You don't do honour to my induſtry and contrivance, &c. I will now inform you that I made a door which ſtood always open, in order that the air might have a free paſſage; as alſo the proviſions, at ſuch times as my Bees were not in their lethargic ſtate; for, being buried in the earth, as I obſerv'd, they will be oftner hot than cold; and conſequently be frequently in want of food. In the firſt place, before I put them into the caſk, I laid, on the flooring of the hive, an earthen pan fill'd with honey; and, over this honey, a ſheet of paper prick'd full of little holes, in order that the Bees might eat the food juſt mention'd, without any of its ſticking to their legs. By this means they will be ſecured from famine. And now to ſhow you how I furniſhed them with air, I muſt obſerve, that a hole was made about the bottom of my caſk, exactly of the ſame height with, and oppoſite to the door of my hive. Before I ſurrounded my hive with earth, I had introduc'd, by the hole in queſtion, a wooden trough, of ſuch a length that it projected a few inches out of the caſk; and extended inward, to the door of the hive. By means of this trough or gallery, my inſects had an opportunity of going in and out, at pleaſure, and their air was renew'd perpetually.

CLAR. This method of preſerving hives ſeems to me a very happy contrivance, and

eaſily executed. Nevertheleſs, a man who was poſſeſſed of an hundred, or twice that number of hives, would have a conſiderable deal of buſineſs upon his hands, ſhould he be obliged to provide ſo many caſks.

EUGEN. 'Tis really very hard to pleaſe you. Old caſks are not ſo dear a commodity as you may imagine. However, to content you, I will make the thing ſtill eaſier. If you happen to be one day poſſeſs'd of a great number of hives, and only a few old caſks, you ſhall keep theſe for what uſe you pleaſe, and employ long boards in their ſtead; or, to be ſtill more frugal (for I perceive that is what you aim at) you ſhall have hurdles, the holes of which muſt be narrow; theſe muſt be a little higher than the hives; and ſet in form of a partition, of a length proportionable to the number of your hives; you need only ſet up a few ſtakes to ſupport them. There muſt be left, between the two rows of hurdles or boards, a diſtance a little greater than the diameter of the hives. Here a flooring muſt be laid like to that in the caſk; and you muſt place, on this flooring, all your hives one after another; with each its earthen-pan and trough or gallery of communication; which muſt extend, from the door of the hive, without the partition: after this, the whole void ſpace, between the partitions, to the height of the hives, muſt be fill'd with very dry earth. By this means, the greateſt cold, with regard to Bees, will be found but moderate; ſuch as a degree will throw our

inſects into the gentle lethargic ſtate, which is of advantage to them. A moderate cold will, in their hives, be of ſuch a warmth as to invite them to take their food; and the proviſion of honey you will ſupply them with, will compenſate for the want of honey in their ſtore-houſes, which will ſoon be emptied. The aperture I propoſe to be left in the hives, will give them an opportunity of iſſuing forth during fine days; a circumſtance that muſt neceſſarily contribute greatly to their health; and preſerve them from the diſeaſes to which they are ſubject, when too long ſhut up. You likewiſe will not be obliged to viſit them ſo often, as I obſerved would be neceſſary during winter, in order to examine whether their lethargy is not of a deadly kind. In fine, you likewiſe may defend them very eaſily, by this method, from an enemy who is extreamly formidable in the cold ſeaſon. This is the ſort of field-mouſe, concerning whom I before promiſed to treat; and who, whenever he has got into a hive, makes dreadful havock. This creature does not dare to attack our Bees in another ſeaſon, as knowing that he would be made to pay dear for ſuch an attempt. He ſtays till the Bees are benumb'd with cold; on which occaſion he ruſhes into the hive, and devours all the inhabitants of it, who are then unable to make the leaſt reſiſtance. I have ſeen ſome very populous hives deſtroy'd by them in one night. The manner of his eating them is likewiſe worthy of our obſervation. The belly and intrails

of animals are usually the parts which excite the voraciousness of those creatures who feed upon them; but these very parts are not regarded by the field-mouse; he preferring the head and breast, though these parts are drier, and much more scaly.

CLAR. I am less struck with the singularity of this creature's taste, than desirous of knowing how I must drive him from my Bees.

EUGEN. The common way is to put up mouse-traps, near the hives: but then these traps don't destroy all the mice, some of them never failing to get clear off. The shortest way is to prevent any of them from being able to reach the Bees; and this may be done, in our casks or hurdles, by fixing little plates of tin round the holes which serve them for doors; in like manner as at the windows of dove-houses, to prevent pole-cats from creeping into them.

CLAR. I give you my word that my hives shall be well buried, all winter, between two partitions of hurdles. Whatever my gardiner may say to the contrary; what respect soever may be due to antient customs, I will give no credit to them; and buried they shall be in earth, tho' I myself should be forc'd to do this.

EUGEN. You say well. The best method for instructing country people, is to set examples before them. They are commonly very dull with regard to argumentations; but proportionably skilful in imitating whatever may produce profit.

CLAR.

CLAR. I will enable them to imitate. However, before I endeavour at this, ſome illuſtrations will be proper. Is it abſolutely neceſſary that the earth, with which I ſurround my hives, and wherewith I ſhall make the flooring to ſupport them, be dry?

EUGEN. It ought to be thoroughly ſo, and for this reaſon. The fluid emitted by the Bees in perſpiration, would overflow their hive; it would form a thick cloud which muſt incommode them greatly, ſince they would be thus kept, continually, in a ſort of drown'd ſtate; their door would not ſuffice to give a free paſſage to the vapour or fluid we are ſpeaking of. But if the earth employ'd on this occaſion is dry, it will imbibe this fluid like a ſpunge; and the heat of the Bees, driving it out of the hive, thro' the earth, will cauſe it to evaporate.

CLAR. I comprehend this perfectly. In what manner muſt I prevent my Bees from iſſuing forth unſeaſonably; at a time that their hatred of winter, and their tedious captivity, ſhall excite them to launch, imprudently, and ſooner than they ought to do, into the expanſe of outward air? How ſhall I be able to know that the ſeaſon proper for this is not yet come?

EUGEN. I before obſerv'd, that theſe precautions relate eſpecially to the firſt days in ſpring; when ſudden froſts are unexpectedly ſucceeded by gentle weather; when the Bees are cheated by a beautiful day-break, which ſeems to invite them to go forth early, and enjoy a delicious Zephyr; inſtead

whereof they meet with a cold, northern blaſt, that quite freezes them. 'Tis our buſineſs, who are abroad; and conſequently may know the ſtate of the weather; either to confine them, or let them out, accordingly as the weather is colder or warmer. We, in order to be informed of this, need have recourſe to our ſenſes only; but here our ſenſes are frequently very unfaithful in this particular. The ſenſation of Bees, on theſe occaſions, is infinitely more delicate than ours. If you deſire to be very accurate, employ the late invented thermometers, for theſe are of admirable uſe for our purpoſe. Since you are poſſeſſed of one which you conſult daily as an oracle, you know that this inſtrument has an exquiſite ſenſation with regard to heat and cold; and points out, with ſurprizing exactneſs, the ſtate of the air at the time deſired. Place one of theſe thermometers in your hive; and it will inform you, every morning, whether your Bees may go forth from their habitation without danger. If the thermometer points to froſt, you muſt not ſuffer, upon any account, your inſects to go into the fields: but when it points to the temperature of cellars, it is then you may begin to open their doors. I have not yet told you, how doors may be made to hives, without intercepting the paſſage of the air. This is done by fixing, to the trough or gallery of every hive, a ſmall grate made (croſswiſe) of iron-wire, whoſe holes muſt be too ſmall for the Bees to paſs through. Now, if this iron-work is fixed in ſuch a manner, as

to open and ſhut like a window; it will be eaſy for you, in the viſits you muſt make every morning to the hives, during this doubtful ſeaſon, to regulate by this thermometer, the iſſuing forth, or ſtaying at home of your Bees.

CLAR. This is an excellent contrivance. How much honey is neceſſary for ſubſiſting a hive during the winter?

EUGEN. That is according to the populouſneſs of the hive. A pound is ſufficient for ſuch an one as is moſt numerous. The ſureſt way is to put more rather than leſs.

CLAR. I could aſk another queſtion, but will forbear, I having ſo good an opinion of myſelf, as to believe that I am able to anſwer it, without your aſſiſtance. The hives we have been ſpeaking of, which are to be buried in the middle of my garden, either between two partitions, or in caſks; would be expoſed to rain and ſnow, which would wet and moiſten the earth; the water would ſoak through, and conſequently drown my darling inſects; but I will make them a little thatch'd roof, like to that with which the country-people cover the ſtalls for their cattle. I imagine that nothing more need be done.

EUGEN. This would be ſufficient, provided that the roof in queſtion projected a few inches beyond the hives, in order that the rain might be carried off at a conſiderable diſtance from them. You muſt own that I have furniſhed you, and all who are deſirous of putting this

experiment

experiment in execution, with a very cheap method to preſerve your hives during winter, and in the beginning of ſpring. This is the moſt eſſential point with regard to their increaſe; by this means you may ſave above half, and perhaps two thirds, of your Bees. The firſt care of every wiſe government is to be watchful over the lives and health of the inhabitants. We will conſider, at our next meeting, of the duties we owe our inſects, during the other ſeaſons of the year.

CONVERSATION XVIII.

Of the methods for increaſing conſiderably the traffic of wax. Of the produce of hives. Of the journies which Bees are made to undertake.

CLARISSA.

SINCE we are drawing towards the cloſe of our diſcourſes on Bees, I intreat you, Eugenio, not to let me be a ſtranger to any particular which may add to the perfection of this art; an art I intend to make one of the pillars of the ſtate, and which will ſave a great number of its inhabitants.

EUGEN. This is a project, Clariſſa, worthy of yourſelf; and muſt neceſſarily be the effect of a generous heart, and an enlightened underſtanding. In return for the inſtructions I have given you, with regard to Bees; let me know in what manner you propoſe to reap ſuch valuable advantages from them.

CLAR. I will oblige our Bees to pay a great part of the duties which the government draws from our provinces. Theſe inſects, if my ſcheme takes place, ſhall henceforwards pay a conſiderable part of our taxes. This project, which no doubt ſurprizes you, was ſuggeſted by my reflecting

flecting on the prodigious quantity of wax consumed in France; on the price it bears; on the money sent abroad to procure it from foreign countries; and on the vast advantages that would accrue, from the making it as common as the fat of cattle, of which candles are made. By revolving all these things in my mind, I fancy I, at last, have hit upon an easy expedient, for procuring to my native country a very valuable commodity, in one branch of trade; as well by multiplying this commodity prodigiously; as by making it an occasion for easing the common people, and introducing a greater oeconomy in families.

EUGEN. This declaration of yours seems to promise mighty things.

CLAR. And be assured that I'll make good all my assertions. My scheme is founded wholly on the instructions I received from you, and still expect to receive, concerning the best manner of treating Bees. My first step will be, to oblige every one of the inhabitants of my hamlet to get themselves two hives. Not a single family shall be exempt from this injunction. I afterwards will teach them the ingenious methods you have so obligingly communicated to me, in order to preserve our insects during winter, and increase them from year to year. I myself will first set them the example. In a word, I am resolved that, in less than four or five years, my village shall have the reputation, of being the finest wax-manufacture in Europe; and that every

every one of my peaſants ſhall be in the happy condition, to which we are told our excellent Henry IV would have raiſed every individual in his kingdom. I am determined that they, merely by the produce of their hives, ſhall be able to procure themſelves the ſeveral ſweets of life; and furniſh, without difficulty or regret, the taxes laid upon them. I will bring matters ſo well to bear, that their felicity ſhall excite the emulation of their neighbours; and as this emulation muſt ſpread from town to town, the whole kingdom will conſequently be affected by it. My head is ſo full of my project, that I can't poſſibly defer, (till another opportunity) acquainting you with my little ſyſtem. 'Tis impoſſible for me to hold any longer, and I muſt diſburthen myſelf of it. I remember you told me, that a hive produced four or five ſwarms annually. At this rate, a perſon who ſhould have two hives this year, would have ten the next, fifty the year following, and two hundred the fourth year.

EUGEN. Not ſo faſt, good Clariſſa. Have you forgot the fable of *the woman and her pail of milk* *; or the Aſiatic who ſold glaſſes †. In the firſt place, I did not tell you that every hive produced exactly four ſwarms annually; but only, that they ſometimes did this. Secondly, ſuch hives, how numerous ſoever they may be, as have already produced one or two great ſwarms, ſoon become thinly inhabited. For, not to mention

* See la Fontaine's fables.

† See the Perſian tales.

the

the loſſes ſuſtained by the perpetual diminution which death (common to all living creatures) makes among them; other loſſes ariſe alſo from the mixture of old Bees, of which no ſwarms are without: and, if there comes forth a third or fourth ſwarm, they are uſually too weak; and the only method to preſerve theſe laſt ſwarms is, to mix them, or join two in one. When a hive produces ſeveral ſwarms in a year, the ſwarm which iſſues firſt is the moſt valuable; for, beſides its being the moſt numerous, it falls to work in a more favourable ſeaſon. The ſucceeding ſwarms always leſſen in value; conſequently, a conſiderable ſubſtraction muſt be made from your calculation.

CLAR. You quite ruin me. Be ſo good then as to inform me, exactly, how many ſwarms I may depend upon in a year?

EUGEN. If your hives are well looked after; and you take care to couple or join together the weak ſwarms, you may be aſſured that, (one with the other) every hive will produce two ſwarms.

CLAR. Two good ſwarms! That is ſomething. Well, if this be the caſe, I'll proceed in my project. 'Twill, indeed, not advance quite ſo faſt as I imagined; but it perhaps will be more ſucceſsful in the end. I ſay then, if every hive produces two good ſwarms annually; a man who is now poſſeſſed of two good hives, will have ſix next year, eighteen the following, fifty-four

the

the fourth, and one hundred and ſixty-two the fifth, and ſo on.

EUGEN. Your calculation is certainly juſt, bating hazards which, now and then, may make ſome diminution in your computation; however, the more care is taken of hives, the decreaſes we are ſpeaking of, will be leſs in proportion.

CLAR. Your allowing me this, will very much contribute to the ſucceſs of my project. However, it is neceſſary that you inform me of one particular, as my ignorance in it might expoſe me to the ill fate of the woman with her pail of milk, hinted at above. What profit may a hive, when well looked after, produce its owner annually?

EUGEN. This profit varies exceedingly, according to the different places; and 'tis impoſſible for it to be the ſame, every year, in the ſame country. Bees have their years of barrenneſs as well as of abundance; farther, as the queens, in all hives, are not alike prolific; they are not all equally furniſhed with artificers; conſequently, much more work is done (I mean wax made) in ſome hives than in others. However, to give you a certain ſtandard, from which you may calculate exactly; I will inform you what is the general computation, in ſuch parts of the kingdom as are not moſt favourable to Bees. In the places I am ſpeaking of, every hive is ſuppoſed to produce two pounds of wax, and twenty pounds of honey.

CLAR.

CLAR. I'll keep to this calculation. This ſhall be the common ſtandard, from which I'll reckon the profits I intend that my tenants ſhall make. I believe you'll own that my lands are vaſtly favourable to Bees. The beautiful meads which lie round my park; the ſhining rivulets that lave my plants; my flower and kitchen-gardens; my wood; all theſe furniſh ſo vaſt a profuſion of flowers, that my Bees may here riot upon dainties of every kind. If Bees yield two pounds of wax in other places, they ought to produce four upon my eſtate. However, I'll ground my ſcheme only on the foot of the leaſt profit, in order that all perſons may find their account in it. For this purpoſe, I'll not take the honey into the ſuppoſed gains. I'll imagine that the peaſant ſhall make no other uſe of it than to ſupport his family; this will be an addition to his domeſtic food; an addition which will give joy to a way of life which, generally ſpeaking, is too frugal. In a word, I am reſolved that my eſtate ſhall, to borrow an expreſſion from the ſcriptures, be *a land flowing with milk and honey*. As to the pecuniary profits, I propoſe that theſe ſhall ariſe merely from the ſale of the wax, which I ſettle at ten-pence *per* pound *. Methinks I cannot impoſe upon any one, in fixing it at ſo low a price.

* This anſwers to about five-pence farthing, ſterling money.

EUGEN.

EUGEN. So far from it, that you wrong yourſelf. Your eſtimating the value of a hive at only * twenty-pence, will take off every objection that can be made to your project; eſpecially as there are many provinces, in which three or four times † that gain is made.

CLAR. I don't deſire that my hamlet ſhould grow ſo rich. As poverty forces the peaſants to abandon the tillage of the earth; ſuch an abundance or plenty, (from a contrary reaſon) as ſhould ariſe ſolely from theſe products, would cauſe huſbandry to be neglected; and we ourſelves would be the firſt, who ſhould feel the bad effects of ill-placed generoſity. At only twenty-pence a hive, the peaſants (thoſe worthy, induſtrious creatures) would not have an opportunity of growing idle. Nevertheleſs, five years hence, every family who, by their induſtry, ſhould become poſſeſſors of an hundred and fifty hives, would enjoy a yearly income of above one hundred and fifty livres ‖. In caſe this little fortune amazes you, I'll ſubſtract half from it (ſeventy-five livres) to obviate all cavils at my calculation. 'Tis uſual for projectors to magnify, in their computations; whereas I'll diminiſh mine. Nevertheleſs, moſt of the peaſants who live upon my eſtate, pay much leſs than ſeventy livres, in taxes. Farther, they likewiſe will have, an-

* Ten-pence half-penny ſterling.

† The original is, *On en tire un écu, & méme quatre francs*; "whence a crown, or even four livres, are gained."

‖ Six pounds, eleven ſhillings, and three-pence.

nually, three thouſand pound weight of honey, as well for the ſuſtenance of their Bees in winter, as for the ſupport of every family during the whole year round, and even for other occaſions; for although this ſort of fruit of the earth, is far leſs valuable than wax, it yet has an intrinſic value: the government will thereby find a vaſt increaſe of wax, which muſt neceſſarily leſſen the price of tapers; a circumſtance that will be of advantage to my family. Theſe ſeveral benefits will ariſe ſolely from my Bees; and thus I have compleated my project.

EUGEN. I think your ſcheme an admirable one. Give me leave to add the following reflexion. A diſtant profit commonly makes but a faint impreſſion on the minds of the common people. The hopes of a future benefit, of which they have no example, will not be ſtrong enough to prevail over the fears they entertain, with regard to the fatigues (how ſlight ſoever) they muſt go through, in order to ſee thoſe hopes crowned with ſucceſs. 'Twould be even difficult for you to rouze your tenants on this occaſion, unleſs they were animated by ſome preſent advantage, which may be as a ſurety, (to them) with regard to futurity; as if you, for inſtance, could obtain from court (where you have ſome credit) a diminution of the taxes, in proportion to the number of the hives, kept by all perſons ſubject to taxes.

CLAR.

CLAR. You are certainly in the right; and nothing would excite their induſtry ſo much as this. We may be perſuaded, that the miniſtry will give their utmoſt attention to any project calculated for the advantage of trade. Till this favour is obtained, I myſelf will ſupply this defect, and endeavour to excite an emulation in my tenants. By the way, will it not be of infinite advantage to poor peaſants, to be freed for ever from the malice of an envious, revengeful collector; and the proſecution of a mercileſs civil officer? To be enabled to ſatisfy the collector, by giving him ſome pounds of a commodity, which the owner of it poſſeſſed, without being obliged to manufacture it; a commodity that will not coſt him any money; and which he may procure with little pains?

EUGEN. I underſtand you perfectly, and will have my ſhare in the good work. I am reſolved not to leave you, till we ſhall have carried this uſeful and ſalutary ſcheme to its greateſt perfection. To affect this, I will continue to tell you all ſuch particulars as may conduce to it. We attended, in our laſt converſation, to the preſervation and ſuſtenance of the Bees during winter; let us now conſider what is to be done for them in the other ſeaſons. The ſpring which, with regard to us, is merely a ſeaſon of hopes; during which we are ſtill conſuming the fruits gathered by us in the preceding autumn, is, with reſpect to Bees, the ſeaſon wherein the moſt plentiful harveſts are made. Nature, at this time,

diffuſing a new heat, revives all ſuch living creatures as the rigours of winter had benumb'd. The gentle breath of Zephyrus purifies the air. Flora diſcloſes her treaſures. The ſhepherds and Bees are rivals with regard to flowers; and 'tis not till after our little artificers have ſeized their firſt ſweets and their fragrancy, that Cupid culls them, therewith to adorn the boſoms of our fair ſhepherdeſſes.

CLAR. Methinks you are making a paſtoral.

EUGEN. You really draw me from a poetical delirium into which I was plunging. All I mean to ſay, in plain terms, was, that during ſpring and ſummer, the Bees have no need of our care. In thoſe two ſeaſons they can eaſily ſupply themſelves. They then have a profuſion of honey, virgin-wax, crude-wax, in ſhort, of every thing neceſſary. The only circumſtance we then need attend to, is, not to let them want water. I am of opinion, that the neighbourhood of rivers, of large water-ſtreams, of baſons or reſervoirs whoſe margins are high, are diſadvantageous to them. Our inſects are very liable to be drowned in them. Winds and ſtorms whirl them into theſe: not to mention that 'tis with difficulty they can keep themſelves ſteady on the margins or banks; ſome of which are too ſteep, and others too much buffeted by the waves. I would rather there ſhould be ſet, oppoſite to the hive, water in plates or diſhes; which, when not full, will leave a ſlope, whereon a Bee may, when drinking,

drinking, ſtand conveniently dry. This, as I obſerved, is the only office theſe inſects want from us, with regard to food, during the two firſt ſeaſons; but about the end, and ſometimes in the middle of ſummer, they muſt be treated variouſly, according to the different countries. The plenty diſpenſed by your meads, and their cool ſhades, will ſupport your Bees till winter; but nature has not been ſo laviſh of her favours to all countries, as to your happy ſpot. The ſpacious and wealthy plains of Beauce, of the Soſſonnois, of the iſland of France, which are ſo fruitful in corn, are fruitful only to men; they being, with regard to Bees, an ungrateful ſoil. Theſe places could not ſupport ſo great a number of Bees, as many others. 'Tis a cuſtom with the country people I am ſpeaking of, immediately after harveſt, to grub up all the ſtubble, and at the ſame time all the graſs and plants growing among it: ſo that, after the hay is mowed; at leaſt, by that time the corn is ripe, every thing is dry and parched in thoſe parts. There, when 'tis a dry ſummer, the Bees rove about the fields in vain; they don't meet with any flowers; or at leaſt ſo few, that ſuch Bees as are moſt fortunate in their progreſſes, ſcarce get a few pellets of crude-wax; or proviſions enough, in the fields, and out of their hives, to ſuſtain themſelves. In how different a ſituation are theſe Bees from yours? 'Tis not therefore ſufficient that perſons, who may be extremely deſirous of multiplying their hives, endeavour at this; they muſt

firſt conſider whether the places inhabited by them are fit for their purpoſe; they muſt proportion the number of little tenants to the quantity of food which theſe ſpots can furniſh; and not attempt, for inſtance, to keep an hundred hives, where only ten can be ſupported.

CLAR. Methinks all the particulars you now tell me, diminiſh very much the benefits I propos'd to reap from my ſcheme.

EUGEN. Very true; but then 'tis of advantage to its ſucceſs, as it will prevent perſons from making an ill uſe of it, by pointing out its proper limits and extent. Tho', by putting your project in execution, you ſhould eaſe only half the country-people, ſtill the attempt would be highly worthy of you; and I am perſuaded you would be ſatisfied with it. There are in France as many lands (at leaſt) that continue a long time freſh and green, as others which dry up preſently, and become barren with regard to Bees; but the defects in ſome (among the latter) may, by certain expedients, be made of ſervice to our inſects. The defects here hinted at are, that ſome flouriſh too early, and others ceaſe too ſoon to be in flower; by which means, a long interval is left, during which the Bees would be quite deprived of ſuſtenance. Now a method has been found, in ſome countries, to remove the hives, with their inhabitants, elſewhere, and afterwards bring them back again. This is done in manner following, as related in Mr. Maillet's curious deſcription of Egypt. You have heard of the famous inunda-

tions

tions of the Nile, which cover regularly, every year, the dry, burning ſands of Egypt; where, leaving a moſt prolific ſlime, they convert the ſpots ſo overflow'd, into one of the moſt beautiful, and moſt fruitful countries in the world. I am of opinion that this country would be the moſt delightful upon our globe; if the indolence of its inhabitants, the mixture of numberleſs ignorant nations, who all are enemies one to the other; and the avarice of conquerors did not oppoſe perpetually its natural advantages. Spite of the ignorance and ruſticity which have got poſſeſſion of Egypt, there yet remain in it ſeveral foot-ſteps of the induſtry and ſkill of the antient Egyptians. One of their moſt admirable contrivances is, their ſending, annually, the Bees into diſtant countries, in order to get ſuſtenance, at a time when they could not find any at home; and afterwards, to bring them back, as ſhepherds who ſhould travel with their ſheep, and make them feed as they went along. The inhabitants of lower Egypt obſerved antiently, that all the fruits of the earth ripen'd ſooner in upper Egypt, than in their parts; which made a difference, of above ſix weeks, between the two countries. Hence they were prompted to make their Bees, if poſſible, reap an advantage from this interval; or, in other words, to procure them food ſix weeks ſooner than they would have done in their native place. The expedient made uſe of by them, for the purpoſe we are ſpeaking of, is employ'd in this age. About the end of October, all ſuch

inhabitants of lower Egypt as poſſeſs hives, embark them on the Nile, and convey them upon that river, quite to upper Egypt; they obſerving to arrive thither, at the time when the inundation withdrawing, the lands have been ſow'd, and the flowers begin to bud. "The hives being "come to this part of Egypt, are there placed "pyramidically in boats prepared for that pur- "poſe; after being mark'd and number'd by "the ſeveral owners who ſet them there. In "this place the Bees feed, in the fields, during "ſome days. Afterwards, when 'tis ſuppos'd "that they have got in all the honey and wax "that could be met with within two or three "leagues round; their conductors convey them, "in the ſame boats, two or three leagues lower; "and there leave the laborious inſects ſo long "time as is neceſſary for them to collect all the "riches of the ſpot in queſtion." Thus, the nearer they come to the place of their abode, the earth forwards its productions, and the plants flouriſh in proportion: ſo that we may then ſay of the Bees, with ſomething more truth than we obſerve with regard to the ladies, ; that flowers ſpring up under their feet. "In fine, about the "beginning of February, after having travell'd "through the whole length of Egypt (gathering "all the rich produce of thoſe delightful banks of "the Nile) they arrive at the mouth of that river "towards the ocean; whence they ſet out, and re- "turn to their reſpective habitations. For care is "taken, to ſet down exactly, in a roll or regiſter,

"every

" every diſtrict whence the hives ſet out in the " beginning of the ſeaſon; their number; and " the names of the particular perſons who ſent " them; as likewiſe the mark or number of the " boats, in which they were placed, according " to their ſeveral habitations." *

CLAR. It muſt be a ſingular ſpectacle to a traveller, to view whole fleets of Bees, ſailing pompouſly on this noble river. Cleopatra's fleet which went to meet Mark Anthony, was more gaudy indeed; but then it did not reflect ſo much honour on the underſtanding of the Egyptians. But I have heard of ſomething ſtill more ingenious, with regard to our inſects; if we may credit what we are told in *Spectacle de la Nature.*† 'Tis there declar'd, that the Egyptians had found the ſecret of giving an education to Bees, ſuch a one as few animals are capable of acquiring. That they had ſhepherds, who led them to paſture, in the ſame manner as a ſhepherd leads his flock; that the Bees, more tractable than the laſt-mentioned animals, were prompted, merely by a whiſtle, to leave their hives, or return to them; to go from one meadow to another; to fly to the banks of a rivulet; in ſhort, to follow their leader, from village to village, whitherſoever he might think proper.

EUGEN. I alſo have read this relation, or rather little romance; and I remember that the

* Deſcription of Egypt, tom. II. p. 24.

† Tom. III. p. 37. In our Engliſh tranſlation of this excellent work, 'tis Tom. III. p. 23, 24, of the 8vo edition.

author

author quotes, to prove his assertion, a passage from the prophet Isaiah,* and another from St. Cyril. However, notwithstanding these venerable authorities, I believe we may doubt the truth of this assertion; and apply this whistle to sailors concerned in the management of boats; I mean, that it was used about sailing; and to otherwise direct the Egyptian mariners, rather than govern the Bees.

CLAR. But, Eugenio, if Isaiah declares the very words mentioned in *Spectacle de la Nature*, methinks we cannot but give credit to them. Do you consider that 'tis a sacred Writer who speaks?

EUGEN. I bear no less reverence to this divine book than St. Jerom did; and will observe to you (after him) that many things are told in the scripture, conformably to the opinion which prevail'd in that age, and not to the most exact truth.† The sacred Writers express themselves, sometimes, suitably to the notions of the vulgar, rather than agreeably to the accuracy of physics; and for this reason, because human sciences are of little consequence with regard to the knowledge of salvation and sanctification; which is the only end proposed by the Almighty, in giving us the scriptures. Bees, in our age, would not be capable of receiving such an education; and it is more than probable, that those

* See Isaiah V. 26, and VII. 18.

† *Juxta opinionem illius temporis, & non juxta quod rei veritas continebat.* S. Hieron in c. 28.

of

of paſt times were not better qualified to learn, than our preſent inſects. But to reſume our ſubject. Egypt is not the only country in which our inſects are made to travel. Alexander de Montfort tells us, that the Italians who live near the banks of the Po, treat their Bees in much the ſame manner as the Egyptians; that they load boats with hives, and convey them to the neighbourhood of the mountains of Piedmont; that, in proportion as the Bees gather in their harveſt, the boats, by growing heavier, ſink deeper into the water; and that the watermen determine from hence, when their veſſels are loaded ſufficiently; and that 'tis time to carry them back to the place whence they came.

CLAR. This proves to me, how exceedingly advantageous it is for perſons to live in the neighbourhood of a great river, when their fields are not very abundant in flowers, or ſufficient to ſupport our inſects during every ſeaſon. I conceive that Bees, (by taking a little voyage upon a river) and enjoying the ſpring of a dry country, with the autumn of a fat, ſhady ſoil, may thus be ſupported the year round. But in order to do this, the owners of hives muſt live near a navigable river, otherwiſe what I juſt now obſerved would be defeated; and you know that many places have not ſuch an advantage.

EUGEN. This defect may be ſupplied by land-carriage. Columella informs us, that the Greeks conſtantly convey'd every year Bees, from Achaia into Attica; and this becauſe that, at the time

time that the flowers in Achaia are gone, thoſe of Attica began to blow. Montfort relates, that the people of the country of Juliers us'd the ſame practice; and that, at a certain ſeaſon of the year, they carried Bees to the foot of mountains cover'd with thyme, and that of the wild kind. I, indeed, borrow theſe inſtances from remote times, and foreign countries; but as people are commonly apt to ſubſtract many things from theſe relations; I muſt give you an example of what is done among ourſelves, in the center of France, and of which you yourſelf may be eye-witneſs. One of thoſe men, born for the improvement of the arts, and whoſe name deſerves to be tranſmitted to poſterity, (Mr. Proutaut) makes his Bees travel like thoſe of the Grēeks of Achaia. This ingenious artiſt has ſet up a manufacture, for whitening wax, † near Pétiviers, in the dioceſe of Orleans; and there keeps a great number of hives. This ſpot is one of thoſe in which flowers become rare or ſcarce very ſoon, and where few or none are ſeen after the corn is ripen'd. He then ſends his Bees into Beauce, or le Gâtinois, in caſe it has rain'd in thoſe parts. This is a journey of about twenty miles * which he makes them take. But, if he concludes that the Bees could not meet, in either of theſe countries, wherewith to employ themſelves advantageouſly, he then has them carried into Sologne, about the beginning of Auguſt; as knowing

† At Yévre-la-ville.

* The original is, *ſix à ſept lieues*, "ſix or ſeven leagues."

that

that they there will meet with a great many fields of buck-wheat in flower, which will continue ſo till about the end of September.

CLAR. I eaſily conceive, that hives may be carried to a great diſtance in boats. This carriage is gentle, and can hurt Bees very little. But then, methinks the conveying them by land, muſt be attended with many difficulties. In what manner does your induſtrious artiſt act on this occaſion? I preſume that he is not ſo polite as to convey our inſects in a coach or a litter.

EUGEN. The ancient hiſtorians had not acquainted him with the method by which the Greeks us'd to ſend away their Bees by land: but here follows his contrivance, which he practices with ſucceſs. The firſt care is, to examine thoſe hives, ſome of whoſe honey-combs might be broken or ſeparated, by the jolting of the vehicle; they are made faſt one to the other, and againſt the partitions of the hive, by means of ſmall ſticks which may be diſpoſed differently, as occaſion will ſhow. This being done, every hive is ſet upon a packing-cloth, or ſomething like it, the threads of which are very wide: they then turn up the ſides of this cloth, and lay them on the outſide of each hive; and tie them together with a piece of ſmall pack-thread, obſerving to wind it ſeveral times round. They afterwards place in a cart, built for that purpoſe, as many hives as it will hold. The hives are ſet two and two, the whole length of the cart. Over theſe, others are placed, which make, as it were, a

ſecond

ſecond lay or bed of hives. Theſe muſt be always put topſy-turvy; 'tis for the ſake of their honey-combs, and to fix them the better, that the hives are diſpoſed after this manner; for ſuch as have no honey-combs, or very ſmall ones, are placed in their natural ſituation. Care is taken in this ſtowage, not to let one hive ſtop up another; it being eſſentially neceſſary for the Bees to have air; and 'tis for this reaſon they are wrapped up in a coarſe cloth, the threads of which were wove very wide, in order that the air may have a free paſſage, and qualify the violent heat which theſe inſects raiſe in their hives; eſpecially when they move about very tumultuouſly, as often happens in theſe carts. Thoſe uſed for this purpoſe in Yévre, hold from thirty to forty-eight hives. As ſoon as all are thus ſtow'd, the caravans ſet out. If the ſeaſon is ſultry, they travel only in the night; but, in cool days, they make a proper advantage of them. You'll imagine that they don't ride poſt. The horſes muſt not be permitted even to trot; they are led ſlowly, and through the ſmootheſt roads. If any hives are void of honey-combs; or have not ſufficient to ſupport the Bees during their journey, which is more than of one day, they are made to ſtay in the place where they happen to be. The ſort of hives we are ſpeaking of, are taken out of the cart; are ſet upon the ground; and after removing the packing-cloth, an aperture is made at the bottom of every hive; by which the Bees iſſue forth in order to procure themſelves proviſions

abroad. The firſt field they come to ſerves as an inn to them. In the evening, as ſoon as they are all returned, the hives are ſhut up; and being placed again in the cart, they proceed in their journey. When the caravan is arrived at the journey's end, the baſkets are ſet up and down in the gardens; or in fields adjacent to the houſes of different peaſants, who, for a very ſmall reward, undertake to look after them. 'Tis thus that, in ſuch ſpots as are not very abundant in flowers, means are found to ſupply the wants of Bees during the whole year. Your lands want none of theſe contrivances; for which reaſon let us proceed in enumerating ſuch precautions as are neceſſary, in all countries, for the proſperity of thoſe inſects, and their labours. But I perceive that I have employ'd your attention a long time; and yet I have enough to furniſh another compleat converſation, for which reaſon we'll break off here.

CONVERSATION XIX.

Of the precautions neceſſary for making Bees thrive. Of the diſeaſes to which they are ſubject, and their natural death.

EUGENIO.

I Muſt finiſh to day, what I had to obſerve, concerning the care we muſt take of Bees, in order to reap all the advantages poſſible from their hives; and pay ourſelves for the ſervices they receive from us. One of the firſt objects of our care, in ſpring, is the looking after the ſwarms. We muſt watch their going forth, to prevent our loſing any. You have ſeen the manner in which they are taken; the endeavours uſed to make the hive, offer'd to them, agreeable. The Bees muſt not be put, at random, into the firſt that comes to hand. 'Twill be proper to have hives of different ſizes; and proportion, as near as we can, theſe little manſions to the populouſneſs of the ſwarms. Bees don't love to reſide in too wide-extended habitations; and that becauſe they would be too cold in them. Seaſons which would not be hurtful to our inſects in narrow hives, would incommode them in ſpacious ones. They likewiſe would not be ſatisfied with too narrow hives; for, beſides that ſuch would be too hot; they would ſoon want room for

building a number of cells ſuitable to their populouſneſs. However, after we may have taken the utmoſt care (which experience will ſoon teach) for this purpoſe; yet Bees often want room. This happens eſpecially to good hives; to ſuch as have a very prolific queen; and in a favourable ſeaſon. For the ſudden increaſe of this little people; their love of labour join'd to an eaſy and abundant harveſt, ſoon enable them to fill the hive with honey-combs. This we perceive by the honey-combs themſelves, which deſcend to the bottom, and almoſt touch the flooring. This defect, which is merely an exceſs of abundance, is eaſily repair'd; by putting under theſe baſkets, a *Raiſer* or *Stand*,* if I may ſo term it. Theſe ſtands are circles made of the ſame materials, and of a like diameter with the baſket or pannier; and are as ſo many broken pieces of hives, with which thoſe too ſhort are lifted up. By thus enlarging the hives, we give the Bees an opportunity of continuing and lengthning their honey-combs.

CLAR. I am of opinion, that this muſt likewiſe contribute to the multiplication of the ſwarms.

EUGEN. The obſervation you now make, ſhows that you do not yet ſufficiently underſtand my meaning here. I here ſpeak concerning lodging the ſwarms to advantage. Now ſwarms very ſeldom produce other ſwarms the ſame year. The

* In French, *Hauſſe*.

buſineſs therefore here, is not concerning the producing new ſwarms; but only how to contrive matters, ſo as that they may make a conſiderable quantity of wax and honey; and to people them well, in order that they may live warmer in the winter. None but the ſwarms of the preceding year; thoſe which have gone through a winter, give birth to three, four, and ſometimes five ſwarms; and this from the middle of May (at ſooneſt) to the middle of June, at lateſt. I know not whether I obſerved to you, that one of the ſigns by which we know that a hive is going to produce a ſwarm, (the firſt time in the year) is, when we ſee a great number of males or drones appear.

CLAR. I remember your remarking this; but you did not then acquaint me with the reaſon of it. I will tell you that which is now ſuggeſted by myſelf, tho' at the hazard of a correction, which I poſſibly may juſtly deſerve again. Since there is a time when the Bees diſpatch all their males; murther them without remorſe; and that none of them are ſuffered to remain in hives the Bees of which are to paſs the winter: whenever we perceive any of theſe in the ſpring, they muſt neceſſarily have been newly hatch'd; and conſequently a certain indication that a ſwarm will ſoon come forth.

EUGEN. Your argument is ſo very juſt, that no part of it can be objected to. I have but one farther obſervation to make with regard to theſe ſwarms. It may, and no doubt often hap-

pens, that Bees are ſcarce ſettled in the new hive, but the weather changes, turns to cold or rain, and continues ſo many days. Now for Bees to leave their habitation, at theſe times, would be hazarding their lives. Nevertheleſs, they have not yet got any proviſion of crude wax or honey, and nothing to ſubſiſt upon at home. Conſequently our inſects, whether they go abroad or continue in their hives, are equally threatned with death.

CLAR. This is a horrid ſituation. It gives us an image of a city block'd up, and quite unfurniſhed with proviſions: a city which hunger will reduce to the extremes of miſery, if your humanity does not prompt you to throw proviſions into it immediately.

EUGEN. I have taken care of the Bees in this particular. When they happen to be in the ſituation here ſpoken of, they muſt not be left ſo; ſmall plates of honey muſt be ſet in the hive, which yet muſt be taken away again, as ſoon as the weather becomes fine, and will permit the Bees to ſally forth. I proceed now to weak or thin hives; to thoſe, the Bees in which are not numerous enough to people a ſmall hive. When a hive has produced two or three ſwarms, 'tis often adviſeable to prevent its producing a third or a fourth, ſince this would only weaken the hive whence they ſhould iſſue. The applying the *Raiſers* or ſands juſt now ſpoke of, are commonly ſufficient to prevent theſe ſallies. As our inſects, by this means, find themſelves more at large, and

leſs incommoded by heat, they don't think of changing their ſituation. But if endeavours were uſed, to no purpoſe, to ſtop them; we then muſt have recourſe to an expedient mentioned before, I mean, the joining two in one; an operation which I muſt explain to you a little farther. Such hives as have already given birth to one or two great ſwarms; tho' theſe hives were ever ſo populous before, they now are greatly thinn'd or weakned; and if a third or fourth ſwarm comes from them, the latter are uſually too weak to be brought up ſeparately. The moſt effectual method for preſerving theſe ſwarms, as I obſerved above, is to join two in one; and this is moſt eaſily done in manner following. We take the hive which is to be emptied, and bring it near that to which we intend to join the Bees contain'd in it. You'll obſerve that ſuch an operation, which muſt neceſſarily confuſe the Bees, ſhould always be perform'd in the morning or the evening; as the Bees are leſs vigorous at thoſe times. The two hives in queſtion being brought near to one another, the firſt muſt be ſhook ſtrongly againſt the earth, or on a table, when the Bees will fall out in cluſters; tho' the ſmall honey-combs contained in them ſhould fall alſo, very little harm would enſue, as they are yet very ſmall and light. Immediately the ſecond hive is ſet over the groop or body of Bees that were ſhaken out; a little after which the latter riſe up into it, and mix with the new companions before ſettled in it: and this they do at once, provided there is a queen in both ſwarms.

CLAR.

CLAR. A much greater ſimplicity appears, in this operation, than I at firſt imagin'd. Is the ſame method uſed, for driving out the Bees from a hive we want to deſtroy, and to remove the inſects into another hive?

EUGEN. We muſt firſt know the circumſtances in which ſuch a deſtruction will be neceſſary. I am acquainted with only three. Firſt, when the body of the hive is grown too crazy, and almoſt worn out: ſecondly, when the falſe moths have got ſuch ſtrong footing in a hive, that the true owners will ſoon be forced to abandon it to them: thirdly, when a perſon is determined not to increaſe the number of his hives. The moſt common way, of ſhifting Bees from one habitation to another, is in manner following. The hive, whence the Bees are to be diſlodged, muſt be turned upſide down. A thouſand ways may be found, for holding a hive topſy turvy. The hive thus reverſed, being ſet firm, muſt be covered with another empty hive, plac'd upon it, bottom againſt bottom. But as it is ſcarce poſſible that two hives, when thus diſpoſed, ſhould match or tally exactly at their lower brims; and as ſeveral holes or apertures would be left, throughout the whole circumference where they join, by which apertures the Bees would eſcape; the circumference abovementioned muſt be inſtantly cloſed or ſurrounded with earth, mix'd with cow-dung; and to ſecure this ſtill better, the circle of earth and cow-dung muſt be incompaſſed (two or three times) with

a cloth; and wrought ſo cloſe that all the Bees may be kept in. Matters being thus prepared, we ſtrike, with two ſmall ſticks, held in each hand, againſt the oppoſite ſides of the lower hive; when this noiſe diſturbing the Bees, they immediately are put in motion; they humm; and this humming increaſes, till ſuch time as many determine to quit an inverted habitation, where they are ſo much diſturbed, and paſs into the upper hive. When the mother-Bee is determin'd to aſcend into it, ſhe is ſoon followed by the major part of the Bees; but then ſhe is too frequently indolent; or ſo ſtrongly attached to her antient abode, that we ſometimes might beat whole hours upon the hive, and yet not make the Bees diſlodge. This is diſcovered by approaching our ear to the upper hive. When a great noiſe is heard in the latter, it is a certain ſign that a conſiderable number of Bees are got into it, and the mother-Bee likewiſe. We then may ſeparate the two hives. However, if the mother-Bee does not abandon the hive willingly, but ſhould perſiſt to continue in her firſt abode, I have diſcovered a ſpeedy way to finiſh this conteſt. We need only ſhake the two hives with our arms, as ſtrongly as we can, but without ſevering or parting them. This violent agitation determines many of our inſects to paſs into the empty hive. How inconſiderable ſoever their number may be, they will be ſufficient to cauſe the empty hive to be tenanted by all the reſt; eſpecially if we ſever the two hives, and inſtantly carry the hive

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we want to fill, to the place where ſtood that which we intend to empty. This is a very eſſential point. As ſoon as the former is ſet in its place (as I obſerved) a ſheet or cloth muſt be ſpread on the ground; then a little board muſt be taken, one end of which muſt lie on the ſheet, and the other on the prop, and oppoſite to the door of the hive that is to be fill'd. This being done, the old hive muſt be ſtrongly ſhaken over the ſheet, in order to force out, upon it, all the obſtinate Bees. The Bees in queſtion falling in heaps, and being near to the place of their abode, know it again, and always direct themſelves towards it. We ſee them advance, in companies, that way; walking upon the board, which ſerves them as a bridge. However if, ſpite of theſe precautions, ſome Bees ſhould ſtick faſt, (how ſtrongly ſoever the hives may be ſhaken) the honey-combs muſt then be cut; muſt be ſwept (as it were) with the feather of a quill; by which means the obſtinate Bees will be forc'd down upon the ſheet, and thus be obliged to go and join their companions. Another method employ'd in country-places, for diſlodging Bees, is to ſmoak them as we do foxes. But this is executed in ſuch a manner, as generally proves fatal to a great number of our inſects; they running the hazard of being burnt to death, either by the unſkilfulneſs of the perſons who direct the ſmoak; or by the confuſion into which this throws the Bees, many of them ruſhing then into the flames. Nevertheleſs, as this is the plain-

eſt and eaſieſt method that can be uſed, I have endeavoured to correct ſuch things as may be amiſs in it, and that in manner following. I firſt get a board, a little broader than the bottom of a hive; and in this board a great number of little holes muſt be bored, ſo ſmall that the Bees cannot paſs through them. I then lay this board over a ſort of pail; and, over the board, the hive whence I want to drive out the Bees; taking care to ſtop all the holes through which the Bees might eſcape, and leaving none open except thoſe of the board. Every thing being ready, I make, at the top of the hive in queſtion, a hole about one or two inches broad; and immediately place, at the opening of this hole, the hive into which I want to drive the Bees. I now lay, at the bottom of my pail, burning pieces of old linnen rags that emit thick ſmoak. The ſmoak now riſing, and paſſing through the holes of the board, ſpreads into the hive, and there forms a thick cloud, which diſturbs and tortures the Bees; who, in order to avoid being ſtifled, aſcend to the top; where meeting with an opening, they thereby ſecure themſelves from the ſmoak, and take ſanctuary in the empty hive, which is ready to receive them, and where they are eaſily detain'd.

CLAR. I have much more eſteem for thoſe who improve arts, than for the inventers of them; and have been told, that the invention of arts was generally the effect of chance; but that the improvement of them, was the reſult of ſtudy,

application, and genius; hence I infer, that you merit many encomiums, and theſe I will entertain you with, whenever you think proper.

EUGEN. Praiſe is a ſmoak with which moſt human brains are delighted, and take it in even to intoxication. But I beſeech you to ſpare mine, which the fainteſt vapour would overpower; and force it to ſeek for ſome hole to glide through, in like manner as the Bees when fumigated.

CLAR. I promiſe not to offend you in this particular, provided you will inform me what materials are fitteſt to make hives with, and the form or ſhape moſt proper for them?

EUGEN. The materials are neither rare nor valuable. Oſier-twigs, thoſe of the wild-vine, ſtraw, boards, and the trunk of a hollow-tree, are the materials commonly employ'd; and ſome of theſe are uſed, preferable to ours, in different countries.

CLAR. I know a country where much more valuable materials are employ'd. I read the other day, that the Engliſh have, in Barbadoes, above four hundred pieces of cannon *, moſt of which are employ'd as Bee-hives. This is what we may juſtly call raiſing ſolid works.

EUGEN. I don't think it will be neceſſary to make ſuch ſolid hives here. I take thoſe to be the beſt, which are raiſed with wreathes of rye-

* *Political State of Europe*, Tom. V. Part II.

ſtraw;

ſtraw; like to yours, and moſt of thoſe in Brabant and Beauce.

CLAR. Why are they made of this ſtraw, preferable to the other materials you ſpoke of?

EUGEN. The Bees are better ſecur'd, by theſe hives, from extreme cold in winter, and violent heat in ſummer; theſe heating and cooling more ſlowly than the others. This forms a ſufficient objection againſt hives made of brick, which are uſed in ſome places, they being the very worſt of all. But the beſt, in my opinion, are ſuch as are made of the barks of cork-tree, in countries abounding with them, Palladius, an antient writer on rural affairs, prefers them to any other. Thus much for the materials. I now come to the figure moſt ſuitable to hives, and this I take to be ſuch a one as is nearly conical.

CLAR. You perhaps imagine that I underſtand foreign Languages?

EUGEN. I own my fault: I mean that they muſt be ſhap'd like a ſugar-loaf, but not ſharp-pointed at the top. The inſide muſt terminate in an arch, in order that ſeveral honey-combs may be the more eaſily fixed in it. If the hives are made of wreathes of ſtraw, or ſuch like, whoſe parts are not wove cloſe; it will be proper to plaiſter the outſide, or do ſomething equivalent to this; to prevent the air and water from penetrating, and to ſpare the Bees the trouble of ſtopping thoſe apertures with virgin-wax.

CLAR. I am highly delighted with this laſt precaution; nothing being more agreeable to me than to ſave the labour of ſuch as ſerve me.

EUGEN.

EUGEN. People generally find their account in obſerving this maxim; and, in the preſent caſe, the profit is viſible, ſince the time which the Bees would ſpend in ſtopping the crannies of their hives, will be employ'd in making wax for you. Another circumſtance, likewiſe of the greateſt importance, is to place your hives in the moſt favourable ſituation you can. They muſt never be ſet towards the north. The ſouth is beſt; in order that the Bees may enjoy the riſing ſun as ſoon, and the ſetting ſun as late, as poſſible. However, if neceſſity ſhould oblige us to diſpoſe of them otherwiſe, either from the diſpoſition of the particular ſpot, or that of the place itſelf; we then muſt be contented with the riſing or ſetting ſun. But particular care muſt be taken, that ſuch a roof be raiſed as may ſhelter the hives from rain and the ſcorching rays of the ſun; for ſome days, in ſummer, are ſo exceſſively hot, that the ſun would melt the wax, and make the honey-combs fall. Such perſons as are not poſſeſſed of hives enough, or are not able to build one common roof, muſt make each of them a very thick covering of ſtraw. Our obligations to Bees are ſo great, that we cannot take too much care of them.

CLAR. I am of your opinion, and think that we ſhould endeavour to make their habitations as commodious as poſſible. However, an article no leſs eſſential, is their food: let us ſpeak concerning it, and I muſt intreat you to free me from a perplexity with which I have been

been long troubled, as well with regard to my Bees, as for myſelf. I don't doubt but that ſome flowers are hurtful to them; and that they have their hemlock as well as mankind. There are other plants (you nam'd one of them to me) which produce a honey that is very unwholſome to us. By the rule of contraries, ſome flowers muſt be more ſalutary, with reſpect to Bees, than others; and certain flowers which produce a honey more ſalubrious with regard to man, and more pleaſing to his palate. I therefore expect, from you, a dictionary of ſimples for the uſe of Bees. You perceive that my health is concerned in this; and you perhaps will think me, at the ſame time, ſomething of an epicure.

EUGEN. I ſhould be exceedingly glad, from the reſpect I bear to your taſte, and the regard I have for your health, was it in my power to draw up ſuch a dictionary as you mention. It would be of uſe to you, and do me great honour, I imagining that it would be the firſt in its kind; but then I don't care to advance any aſſertions at random. Our knowledge, in the ſubject we are ſpeaking of, is exceedingly imperfect. The only flowers I know which our inſects refuſe, are thoſe of elder and rue; and I am not acquainted with any which poiſon them. Experience indeed ſhews, that certain kinds of honey agree with us better than others; and ſome are found vaſtly prejudicial. But, to pretend to fix the degrees, with regard to the wholſomneſs, or malignity of every flower, would, I believe,

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be a very idle attempt. I am of opinion, that ſuch places as abound with thyme, wild thyme, jeſſamine, roſemary, broom, and other odoriferous plants, muſt produce a good-taſted balſamic honey; ſuch as that of *mons Hymettus*, which the Greeks ſo highly priz'd; ſuch as our Narbonne honey. I fancy that the flowers of our corn of every kind, of our pulſe, of our fruit-trees, produce a honey leſs agreeable to the ſmell; but this honey may probably contribute as much, or more, to procure as good nouriſhment. As to plants which may produce a honey of a noxious quality, I have not made any experiment with regard to ſuch. However, I am apt to think that hen-bane, milk-thiſtle, hemlock, and ſuch like, whoſe juice is known to be hurtful, may very poſſibly communicate their malignity to the honey that ſhould be extracted from them. For this reaſon, I would make no difficulty to grub up all ſuch pernicious weeds, in the places adjacent to my hives.

CLAR. You have now pronounc'd their doom; for not one of them ſhall be ſeen throughout the whole extent of my demeſnes. After having thus provided our little tenants with ſuitable lodging and food, let us now conſider their diſeaſes, for they are liable to ſome: my gardiner has often told me, of the great havock made among our Bees by the meazles, and by purgings both upwards and downwards.

EUGEN.

EUGEN. I don't doubt but that you'll be gladly told, that the meazles are only an imaginary diſtemper. Abbé de la Ferriére, who has given excellent precepts with regard to the management of Bees, miſtakes (as many others, have done) in ſuppoſing the meazles to be a diſtemper of vaſtly fatal conſequence to Bees. He ſays this diſeaſe *ariſes from a ſort of wild honey; a red, thick ſubſtance, which does not fill above half the cells; that it is more bitter than ſweet, grows yellowiſh, and breeds worms or maggots which deſtroy the Bees.*

CLAR. Let me anſwer Abbé de la Ferrére, for methinks I have been taught ſo much, that I myſelf ſhall be able to confute his arguments. As he ſuppoſes that the meazles are a ſubſtance which engender worms, I deny his whole ſyſtem; it not being poſſible for inanimate matter to engender or procreate.

EUGEN. Your anſwer is quite conformable both to reaſon and experience. But this is not the only circumſtance in this writer that merits cenſure. What he calls wild honey is not honey; it is crude wax; a ſubſtance exceedingly neceſſary for the ſupport, as well as for the works, of Bees. I obſerved to you, ſome time ſince, that crude-wax retained the colour of the *ſtamina of flowers*, of which it was form'd; it being yellow, yellowiſh, white; ſometimes green, and ſometimes red. Thus what he calls the *meazles*, was merely red crude-wax; a ſubſtance fit to nouriſh Bees, and not make them ſick. But it is different with reſpect

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to the purgings hinted at above, these being a real disease; which some ascribe to the new honey they feed upon during the spring, and on cold days. But methinks it is more probable to suppose, that this distemper arises from the Bees being forced, for a long time together, to live upon honey only, and without a supply of crude-wax. I have frequently experienc'd, that such Bees as I fed with nothing but honey, were troubled with purging downwards. *Vandergroen*, or the *gardiner of the low-countries*, affirms that such of our insects are troubled with purgings of this kind, as are in want of bread; for thus he terms, and properly enough, crude-wax.

CLAR. How do you reconcile this, with the pots or plates of pure honey, which you leave in the hives, to support the tenants of it during winter?

EUGEN. This does not clash in any manner with that practice. Call to mind that our insects make a provision of crude-wax, as well as of honey; and have store-houses of each; and since experience has taught us, that we need only furnish them with pure honey, sufficient to make up for the scarcity of it during long winters; we thence may infer, that the quantity of crude-wax hoarded by the Bees, is sufficient to serve them, during the longest winters; but that their provision of honey is soon consumed. Hence we may suppose, that, during the season in question, their consumption of bread is infinitely less than that of honey; though the contrary happens during

ing ſummer. But we likewiſe may take it for granted, that as pure honey incommodes them; ſome of this bread, tho' in ever ſuch little quantities, is abſolutely neceſſary to them; and the want of it attended with fatal conſequences.

CLAR. Be ſo good as to inform me of the ſymptoms and effects of this diſeaſe, as well as the method to cure it.

EUGEN. Don't expect, from me, a conſultation in form. The phyſicians of Bees procure their licences ſo very cheap, that the only thing we can require at their hands is experience. All I know concerning the diſtemper we are ſpeaking of is this. Bees, when moſt in health, evacuate the dregs of their food in a liquid form. When groop'd or cluſter'd in the hives, they fix themſelves in ſuch a manner, as not to incommode their neighbours therewith; all of it falling to the bottom of the hive. But as pure honey does not form a food ſufficiently ſubſtantial for them; whenever they feed too long upon it, without having any bread, they grow weaker daily; and this weakneſs increaſes to ſuch a degree, that they, at laſt, are unable to quit their hives, or even to diſengage themſelves one from the other. 'Tis on theſe occaſions that, not having ſtrength enough to move ever ſo little; thoſe fix'd above drop, on the others beneath them, a clammy, liquid ſubſtance; which wets them, ſpoils their wings, and ſtops up the canals through which they perſpire. Such as ſhould yet be quite free from this diſtemper, loſe their lives merely by the

the contact of the ſick. An experiment I made on this occaſion, will give you a much better idea of this diſtemper, its ſymptoms and effects. I had fix'd ſome Bees in a hive, without leaving them any honey-combs; or even the liberty of ſeeking their food abroad. However, to compenſate for this, I ſupplied them with pure honey. At firſt I let them feed but ſparingly, and kept them alive above three weeks: however, I afterwards was too bountiful; they eating ſo much, that they ſoon had purgings; they wetted one another; and, ſome days after, they all died; and were as wet, on this occaſion, as if they had been dipp'd in water thickned with honey.

CLAR. This really is a diſtemper of extreme bad conſequence: I therefore muſt deſire you to inform me, as ſoon as poſſible, how it may be cur'd?

EUGEN. Abbé de la Ferriére, above-mentioned, ſpeaks much better with regard to this diſeaſe, than concerning the meazles. He gives us a recipe which is very like ſeveral others, that had been preſcribed before him; and is as follows: take half a pound of ſugar, the ſame quantity of good honey, a pint of * red wine, and about a quarter of a pound of fine bean-meal or flower: mix all theſe together, and ſet the mixture, on a plate, for the Bees. This, very probably, may be a good preſcription, but I know one that is much ſafer, and leſs compli-

* The French is *chopine*.

cated, *viz.* to take from another hive, a honey-comb, whoſe cells are fill'd with crude-honey, and give this to the ſick Bees.

CLAR. I am for your preſcription. As the ſole cauſe of the weakneſs and infirmity of theſe Bees, is from their wanting ſuch ſuſtenance as may ſtrengthen them; it would be needleſs to uſe compoſitions, the doſes or qualities of which are always arbitrary; when we ourſelves have, within our reach, the very ſuſtenance on which they naturally feed. Let us now proceed to ſome other diſeaſe; and ſince we are on this topic, we will even go through our whole courſe of phyſic.

EUGEN. This will be ſoon done. The diſtemper I juſt now treated of, is the only one (at leaſt that I know of) to which Bees are ſubject. Perhaps they may have certain maladies which are unknown to us, but then theſe muſt attack our inſects very rarely; and we may affirm, that they don't proceed from any irregularity or exceſs in the Bees. Moſt of the diſeaſes which attack man's life, are the conſequences of, and the puniſhment for, the ill uſe he makes of the things given him to preſerve it. But the Bees, faithful to the laws of nature, and keeping within the limits preſcribed to them, ſuffer no other defect in their conſtitution, than ſuch as are owing to the general laws of the univerſe. They never die except through old age, or from ſuch accidents as are unavoidable.

CLAR.

CLAR. The words old age remind me of a queſtion I often intended to aſk you. How long is the life of a Bee, that has eſcap'd all the hazards which might otherwiſe have ſhortned its courſe?

EUGEN. Some authors affirm that they live ten years, others ſeven; and Abbé de la Ferriére, one of the moſt knowing among theſe writers, is of opinion, that they don't live above a year. I made an experiment, which inclines me to this Abbé's opinion. However, as my experiment was not accurate enough, for me to pronounce affirmatively on this occaſion; I fancy that all we are told concerning the duration of a Bee's life, is hitherto very uncertain. Was it poſſible for us to keep a Bee in a cage, as we do birds, we then might ſatisfy ourſelves fully in this particular; but a Bee does not live apart from her companions. Hives are like cities, which ſhould have freſh inhabitants every year; and whoſe houſes ſhould exiſt much longer than the ſeveral tenants of them. In fine, I will not ſcruple to cloſe the hiſtory of the life of the Bees, with confeſſing my ignorance concerning the limits which nature has preſcribed to it. I imagine, Clariſſa, that you, by this time, know enough to eſtabliſh on your eſtate, the nobleſt manufacture of wax in the kingdom. I could have mentioned ſeveral little operations; many practices uſed in the management of hives; but what you want to be inſtructed in farther, is known to the meaneſt peaſant; and the ſuperintendant of your Bees, who has ſo long had the

direction of them, will inform you ſufficiently concerning theſe matters; not to mention, that you will meet with ſeveral things, for your purpoſe, in books. I promiſed you nothing but the natural hiſtory of Bees, and have told you all I know on this ſubject. To the inſtructions I have here given, do you add your own ſagacity, your underſtanding, and your zeal for the public good; you then will be enabled to carry the art, of proſpering and multiplying Bees, to its higheſt perfection.

FINIS.

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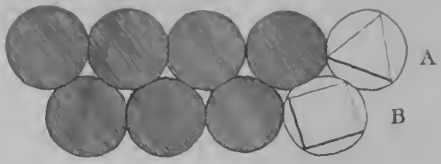

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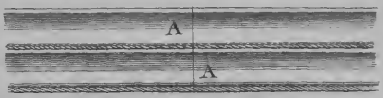

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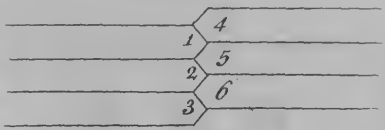

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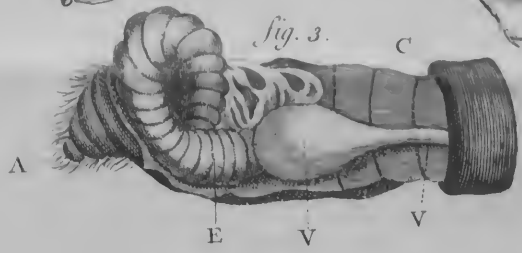
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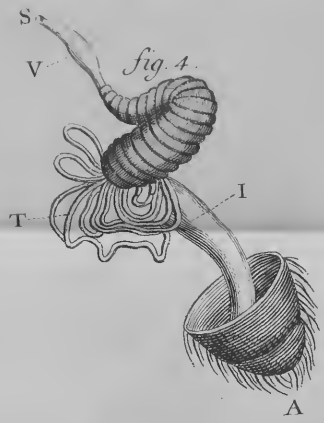
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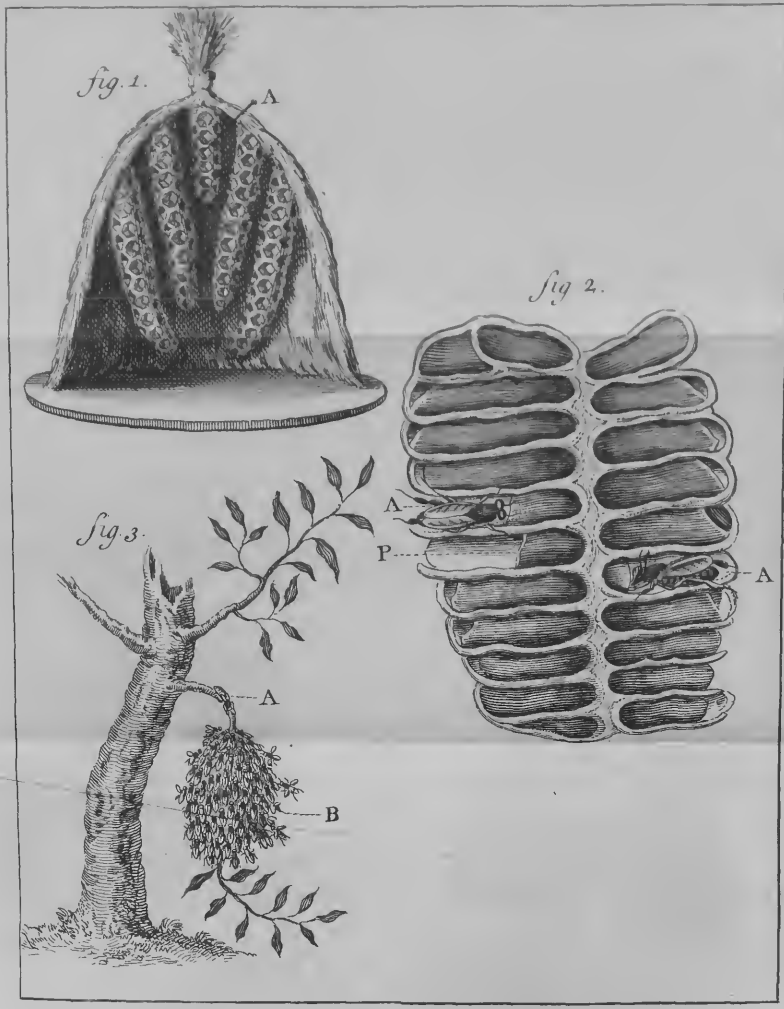
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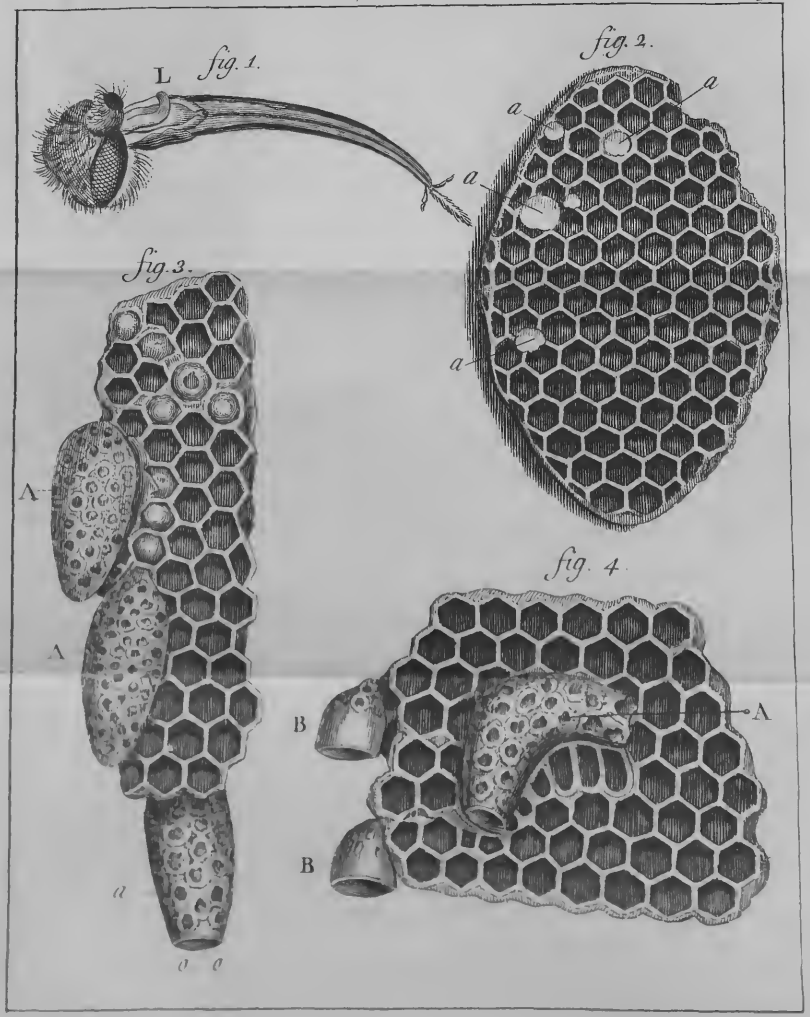

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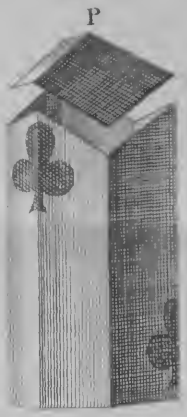

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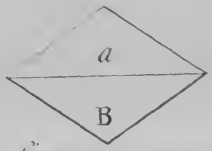

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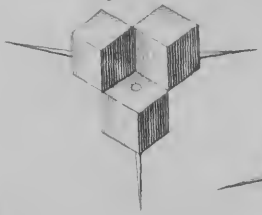

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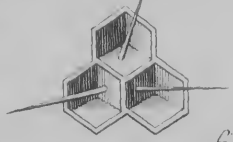

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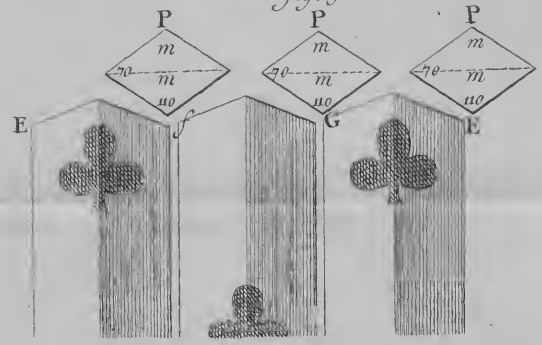

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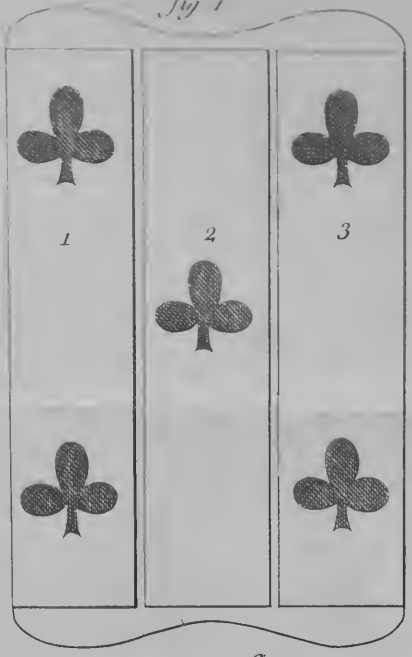

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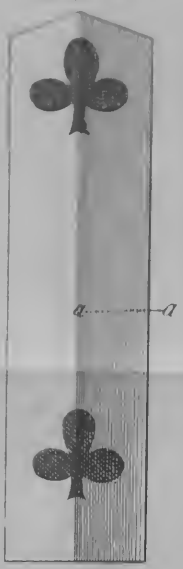

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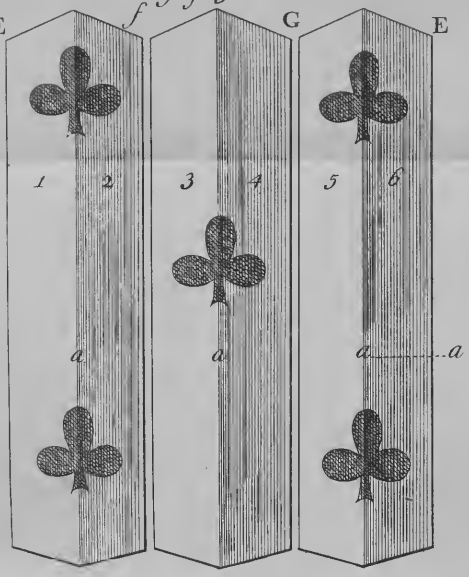

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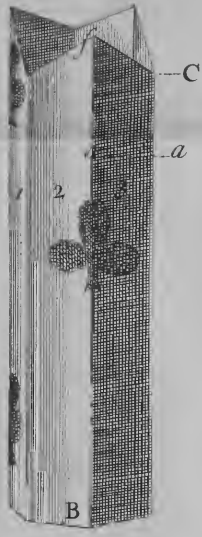

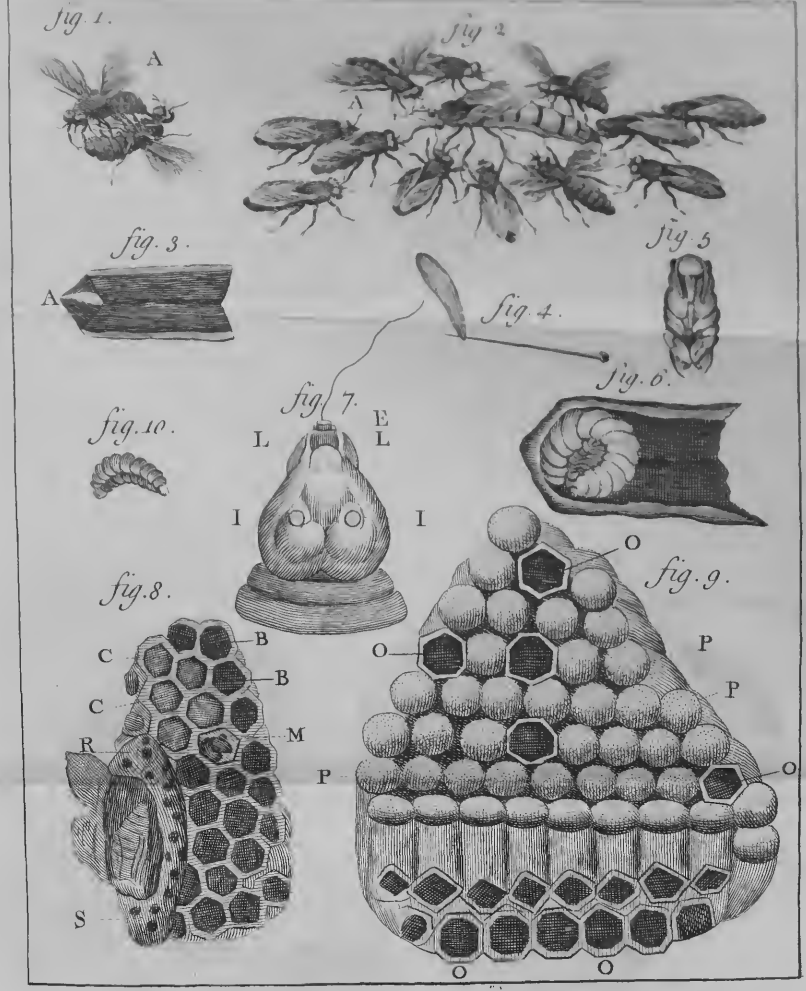
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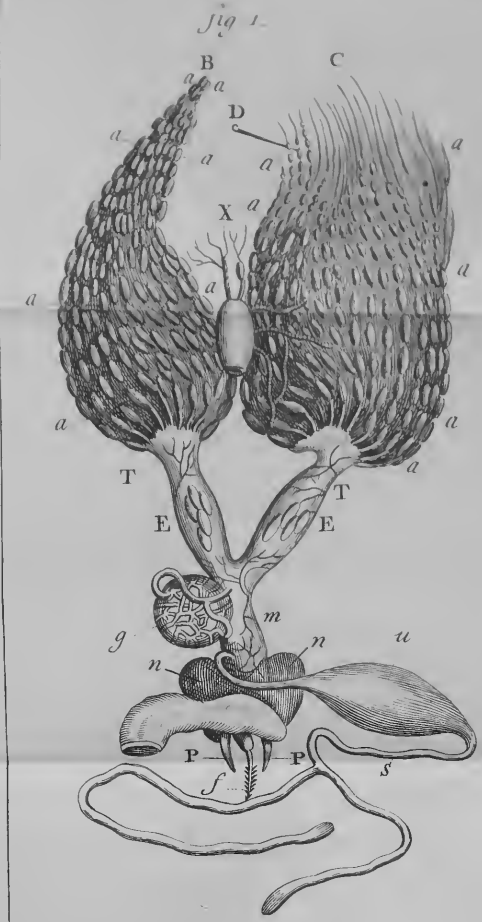
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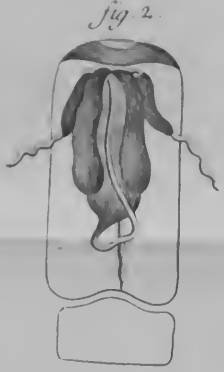
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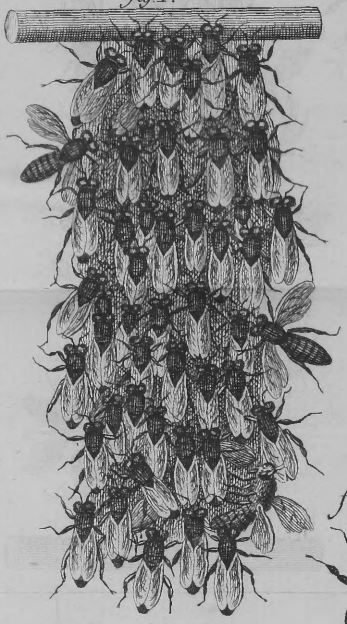

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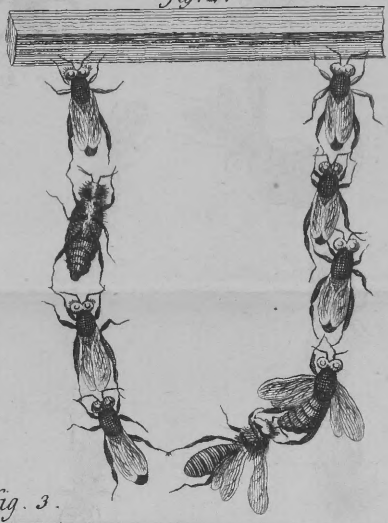

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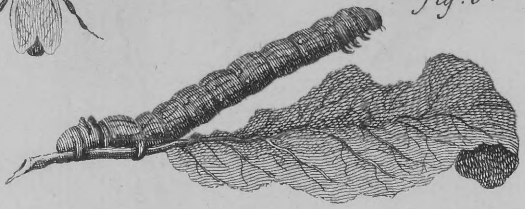

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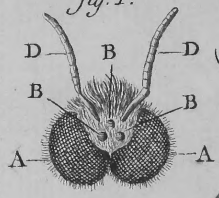

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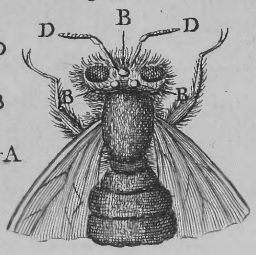

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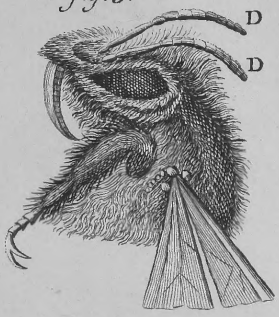

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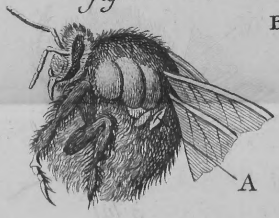

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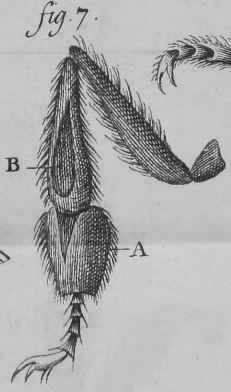

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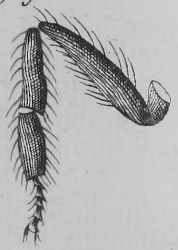

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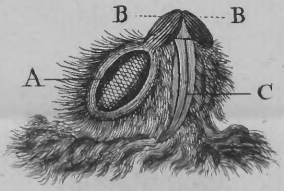

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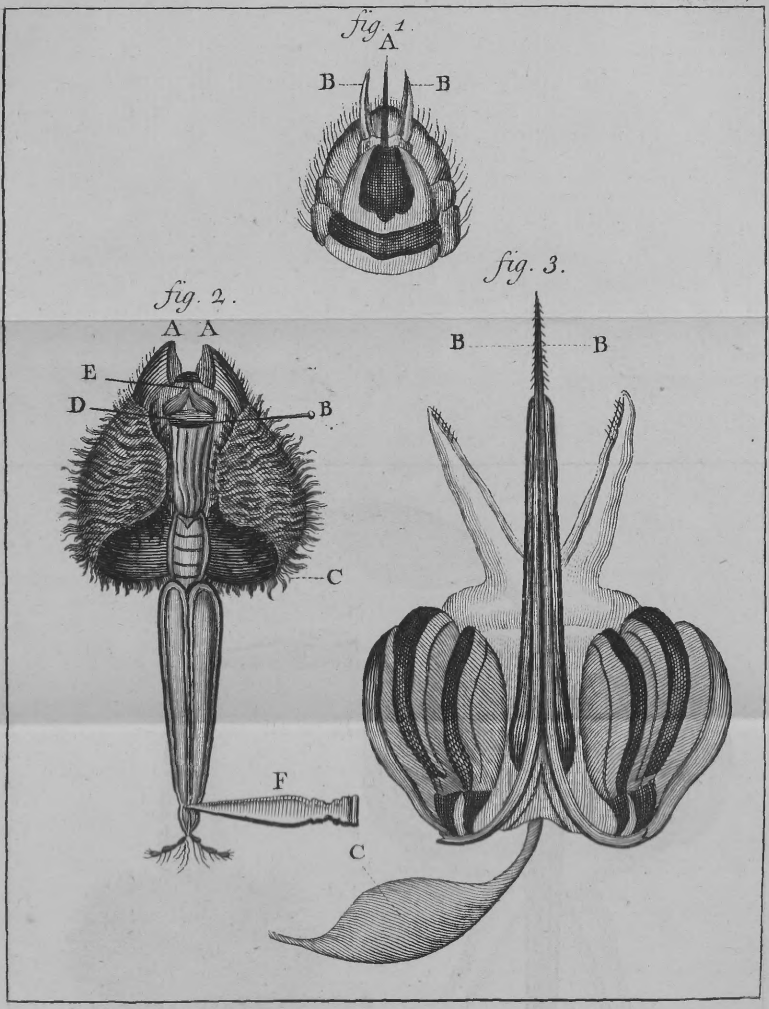
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